COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

New York, April, 1934

Carry On!

WHEN NRA sent out its A-B-C-D blanks for reports on November operations under the bituminous code, many coal companies secretly rebelled at the voluminous work entailed. But now that the results of this work are available for study, there are few managements which will not admit that the information revealed was worth the effort. Each producer can now see his own operations in relation to the consolidated averages for his district or division and for the country.

Full value from these statistics, however, cannot be realized until the figures have been carried forward for at least a year. Regardless of what NRA may decree with respect to future monthly compilations, the industry itself should see to it that the work is continued. As John Doolin told the Rocky Mountain Coal Mining Institute, compilation of the first reports was expensive, but it would be much more costly to the industry to fail to carry on.

Shorter Hours

OPPOSITION to a shorter work-day in the bituminous coal industry has been based upon no Median conviction that either wages should be held down or hours of labor stretched out. Most mines have been planned and developed on a basis of producing a desired tonnage in an eight-hour day. To change now means not only increased direct and indirect production costs but also, in many cases, additional capital investment in equipment to step up the hourly rate of output.

The bait that these increases in costs have been exaggerated because men will produce as much coal in six or seven hours as they have in eight is too illusive to attract hard-headed management which must plan on something more tangible. Moreover, if this promise of labor can be fulfilled, then the major objective of hour-shortening, which is to increase employment opportunities, fails. Management plays a safer game when it proceeds on the theory that a shortening of the work-day cannot be achieved without increased costs.

Embarkation upon a program of reduced hours with or without increases in the hourly rates, therefore, can be supported only upon the assumption that this program can be undertaken without further jeopardizing the market for coal. This, of course, implies government aid in establishing and maintaining proper competitive relationships with oil and gas and a sharp curtailment of government financing of hydro-electric developments to diminish coal consumption further and deprive miners of opportunities for employment. Without these assurances and without recognition of the highly seasonal character of mining in many districts, both the coal-mining industry and the labor employed therein will suffer.

Facing the Music

MANUFACTURERS of coal-mining equipment have complained bitterly at times that customers bypassed them to purchase bootleg parts. And operators justified these orders on the ground that they could buy these parts so much cheaper from local sources. At least one prominent manufacturer is meeting the issue with the flat declaration that "genuine parts will cost you no more and, in some cases, less." That is as it should be, and such courageous selling ought to go far in restoring parts buying to normal channels.

"Yardsticks"

WHEN the Tennessee Valley Authority was created, its entrance into large-scale development of hydro-electric power in a territory already having a generating capacity far in excess of present requirements was defended on the ground that the government needed a yardstick by which to measure the reasonableness of public-utility rates. Secretary Ickes, of the Department of the Interior, defends the erection of a government furniture factory at Reedsville, W. Va., to manufacture postoffice equipment on the same ground. Eventually we may have so many federal yardsticks that no private industry will be left to measure.

Awake at Last

IF THE CONFERENCE of code authorities at Washington last month had done nothing else, its effective focussing of public attention on the necessity for stimulating activity in the capital-goods field in order to put a solid foundation under the recovery program would have been sufficient justification for the meeting. That such stimulation is the key to a sound business revival was recognized early in the depression by a small group of industrialists and economists, but their conclusions found little general acceptance at that time. In the beginning of its campaign, even NRA was inclined to postpone consideration of the relation between capital goods and prosperity.

Part of this indifference, of course, was due to a widespread misunderstanding of the place of capital goods in the economic set-up and to a revulsion against expansion in productive facilities. This expansion was charged with a leading part in the collapse of 1929 and, without discriminating between investment for increased output and investment to retire obsolete equipment, critics of the old order frowned heavily upon support for capital goods. The original draft of one of the early codes submitted, for example, proposed to outlaw the purchase of all new equipment by the particular industry covered during the life of the code!

But the picture is changing rapidly. Signal proof of this is shown in the recent report of the Code Authorities Committee of Consumers' Goods Industries which states that "farther substantial progress in reabsorbing the unemployed necessarily depends upon revival of capital goods." More than 90 per cent of the unemployment now lies outside the field of consumer goods and is largely in the capital-goods industries. Coal has a vital stake in this revival because, aside from the railroads, its largest consumers are in the heavy industries.

Still Unanswered

CLASS 1 RAILROADS, which brag that they have saved approximately $750,000,000 since 1920 through increasing efficiency in their consumption of fuel, continue to demand that they be given special treatment in the matter of coal prices. And the question of why they should be the beneficiaries of a rebate in prices at the expense of other classes of consumers or at the expense of reasonable profits for the mining industry still remains unanswered.

Chlorine in the Air

GRANTED the presence of atmospheric chlorides of sodium and potassium in England and the West, one may speculate as to their effect on mine explosions. Dr. H. B. Dixon has discovered that the halogen bromine, and Prof. R. V. Wheeler that the halogen iodine, raised the temperature at which methane and ethane, respectively, ignited. Dr. Dixon added that the temperature of ignition of these gases is always such as to release halogens from combination and leave them free to act as retardant catalysts. The halogen chlorine is less active than bromine and iodine. On the other hand, the Bureau of Mines has shown that there is ground for the belief, long held, that chlorides or chlorine aid in the combustion of soot, probably as a catalyst that lowers the temperature of ignition.

With these apparent contradictions, which may be more apparent than real, prognostication is dangerous. But one nevertheless may ask whether chlorine is a catalyst aiding in the combustion and explosion of coal dust. A study of this question might explain why such explosions are so rife in the West, though the presence of pulverized resin in some Western mines probably is a more significant cause. A little sodium chloride added to the coal dust in the Experimental Mine, or thrown into the ventilating current, might increase or, perchance, lower, the violence of the explosion.

TIPPLE MODERNIZATION

+Includes Complete Crushing Facilities

And Triples Loading Points

By J. H. EDWARDS
Associate Editor, Coal Age

ONLY a few years ago the new tipple at Mine No. 1 of the Island Creek Coal Co., Holden, W. Va., was featured as a modern plant. Served by a 42-in. belt conveyor extending from mine-slope bottom to tipple—equipped with three picking tables and three loading booms, spanning four loading tracks, the entire structure built of steel—such were some of the features which made it an outstanding plant. But in 1933 the plant was rebuilt, so it now boasts of twelve loading points, equipment to crush the entire output of 400 tons per hour if desired, and fitted to prepare almost any grade of coal or mixture.

The changes were made without disturbing the original installation of main belt conveyor, main shaker, picking tables and loading booms; furthermore, the additional loading points were provided without increasing the number of loading tracks. Strictly speaking, it is still a four-track tipple, but it is equivalent to at least a seven-track tipple. Space limitations, by reason of main-line track, four loading tracks, creek, paved highway and slope portal all crowded into the narrow valley, practically prohibited construction of more tracks. Unusual, and perhaps unique, is the arrangement which provides the additional loading points.

The new equipment, consisting of crushers, crushed-coal shaking screens and high-speed jouncer screens, is fed by a 42-in. belt conveyor onto which the original loading booms, one or all, can be made to discharge by raising these booms and swinging into position short chutes. Thus the picked lump, picked egg, or picked junior egg—any one or all three—can be sent to the crushers.

Capacity of the crusher installation is 400 tons per hour and this includes 75 tons per hour of oversize that may be recirculated from the crushed-coal shaking screens. A bar screen situated ahead of the first crusher shunts out the fines. Between the crushers, which are mounted one above the other, is a vibrator which shunts out the new fines from the second crusher.

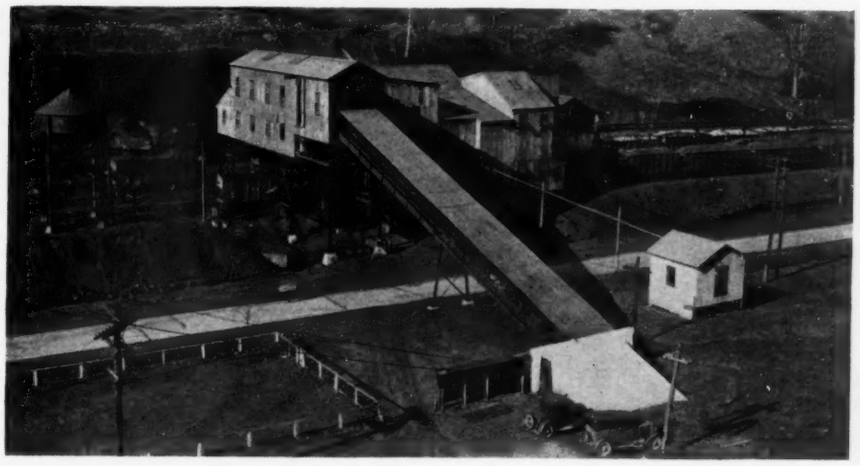
The crushed coal is carried by flight conveyor to a set of crushed-coal screens which divides the product into egg, junior egg, nut, and slack. The egg and junior egg are delivered directly by the chute to the original booms handling these sizes. The slack goes either direct into a loading chute or by belt conveyor to the original slack loading hopper. A 36-in. belt carries slack and nut from the main shaker, also nut from the crushed-coal shaker screen, to the high-speed jouncers, two in number and which can be operated singly or two in parallel as the capacity demands.

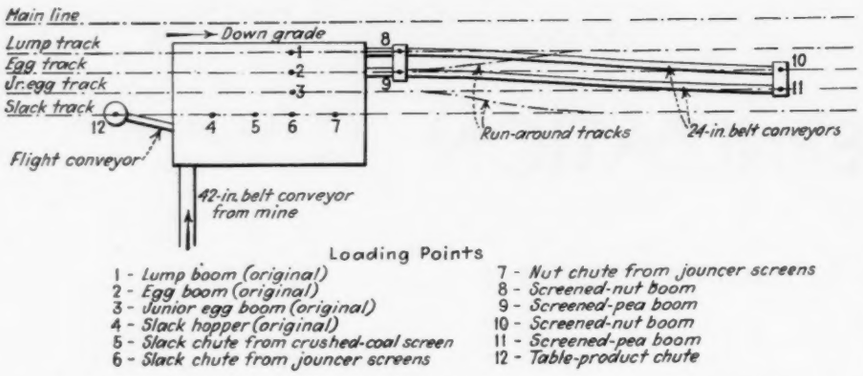
The two larger sizes made on the jouncer screens go to two 42-in. belt conveyor booms on the lump and egg tracks. If, however, lump and egg are being loaded over the original booms, the new booms are then raised to discharge onto 24-in. overhead belt conveyors which extend 165 ft. down the tracks and each cross diagonally to the adjacent tracks. A run-around track was installed from the egg track to the lump track and another installed from the junior-egg to the slack track. The arrangement prevents blocking, regardless of the combinations of sizes being loaded.

The product removed by hand at the three picking tables consists principally of coal from a thin stratum which is of softer structure than the remainder of the bed. To handle this table product separately, two flight conveyors and a 50-ton loading hopper were installed. The hopper, or bin, of round steel construction, is located directly above the slack track and 60 ft. upgrade from the tipple. One of the conveyors is installed crosswise below the three picking tables so as to receive the coal from drop chutes. This conveyor discharges into the second conveyor, which is set at right angles to the first and elevates the coal up to the hopper.

Design and installation of the two 24-in. belt conveyors which serve the auxiliary nut-size loading points, located 165 ft. downgrade from the two new 42-in. belt booms, were handled by the coal company. Belts and idlers were purchased from the Robins Conveying Belt Co. The troughing idlers are spaced on 5½-ft. centers and the return idlers on 11-ft. centers. The hinged end sections forming the loading booms are sup-

At Left, a Loading Hopper 60 Ft. From the Tipple; at Extreme Right, Two Loading Points 200 Ft. From the Tipple.





Twelve Loading Points on Four Tracks, and Run-Arounds to Prevent Blocking.

ported at the ends by Milwaukee 1-ton electric hoists. Structures of the conveyors, terminal frames and trimming platforms are of steel. Contract for the improvements and addition to the tipple proper was let to Heyl & Patterson, Inc., consequently all equipment, including crushers, screens, flight and belt conveyors, loading booms, etc., is of that make.

Crushers are of the double-roll type, rolls being 42 in. in diameter and 48 in. long. The upper, or primary, crusher has manganese-steel segmental rolls fitted with hawkbilled teeth. The lower, or secondary, crusher has charcoal-iron segmental rolls fitted with pyramidal teeth. A 60-hp. 1,160-r.p.m. slip-ring motor drives the upper crusher and a 75-hp. 875-r.p.m. motor drives the lower. The drive in each case consists of flat belt from motor to countershaft, flat belt from countershaft to adjustable roll, and cut-steel gears from countershaft to non-adjustable roll.

Both troughing and return idlers of the five belt conveyors and two belt-type loading booms installed by Heyl & Patterson are equipped with Timken bearings. The 42-in. belt to crushers is 55 ft. long, operates at 300 ft. per minute, and is rated 400 tons per hour. Spacing of the troughing idlers on this belt is 4 ft. and of the return idlers, 10 ft. The belt is 6-ply with $\frac{1}{8}$-in. rubber cover. Next in size is the 36-in. conveyor, 90 ft. long, operating at 375 ft. per minute, and rated 400 tons per hour. Belt ply, cover thickness, and idler spacings are the same as on the 42-in. belt.

Two 24-in. conveyors handling products from the jouncers and another of the same width taking slack from the crushed-coal screens are each 25 ft. long. All of these belts are 4-ply, $\frac{1}{8}$-in. rubber cover and the spacings of the troughing and return idlers are 5 and 10 ft., respectively.

Horizontal sections of the two 42-in. loading booms are 26 ft. 6 in. long, and the hinged sections, 36 ft. long. Belts are 6-ply, $\frac{1}{8}$-in. cover, and the idler spacings are 4 ft. and 10 ft. Motor-drive connections to these booms and to the 36-in. and 42-in. conveyors consist of Texrope belts and cut-steel gears. Corrugated Cop-R-Loy covers protect the hinged section of the booms from the weather.

The vibrating screen located between the crushers is a 4x8-ft., high-speed type, operating on roller bearings. Crushed-coal screens, consisting of upper and lower balanced sections with wood side frames, are carried on hickory supporting springs. Jouncers each consist of two screening decks and one gathering deck. They are 6 ft. wide, have steel frames and are supported on spring steel legs. Eccentrics and eccentric shafts of the jouncers are fitted with Timken bearings. Drives of the vibrating screen and of the two jouncers are by flat belts, but that of the crushed-coal screen is the Texrope and cut-steel gear combination.

During the past year lighting of the picking tables also was modernized. Westinghouse dustproof reflector units

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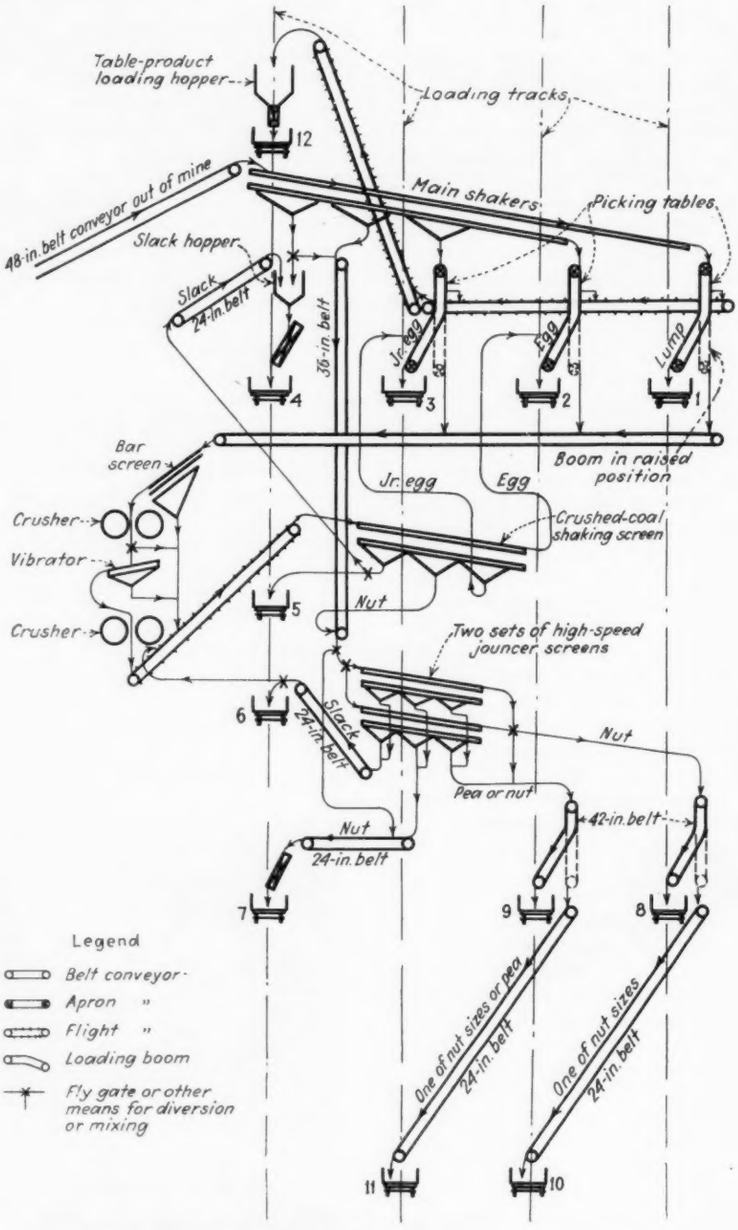

Flowsheet in Which Principal Equipments Are Shown in Approximately Relative Locations.

TEN-YEAR CAMPAIGN

+ For Safety at Phelps Dodge Mines

Yields Worth-While Results*

By GILBERT C. DAVIS

Manager, Stag Canon Branch
Phelps Dodge Corporation
Dawson, N. M.

SAFETY WORK has been a major item of operation at the mines of the Stag Canon branch of the Phelps Dodge Corporation for ten years. These mines, at Dawson, N. M., produce a coking bituminous coal and, during this ten-year period, the work has been in coal from 3½ to 8 ft. thick. A low moisture content results in a very explosive dust and this hazard is further increased by the presence of considerable quantities of highly inflammable gas.

The roof usually is poor quality shale, cut by numerous slips, requiring close timbering. The coal lies practically flat, and the mine is worked largely on the room-and-pillar system. Last year, approximately 17 per cent of the output was pick-mined, 50 per cent was hand-loaded after machines, and 33 per cent was recovered by scraper loading.

A planned safety movement was started in the second half of 1924, coincident with similar activities at the copper-mining branches of the company. The position was taken that both copper and coal mining could be safely carried on. This position has been justified both by the great reduction of human suffering and by cost reduction. The results, from the standpoint of accident-frequency and accident-severity rates, tons mined per accident, and compensation costs, are summarized in Table I. Additional data are shown in Fig. 1.

The frequency rates shown in Table I indicate the number of lost-time accidents per thousand shifts worked; and the severity rate, the percentage of days lost to days worked. A lost-time accident is one in which the workman is unable to resume his regular duties the day following the injury. The severity rate is based on the schedules for lost time used by the U. S. Bureau of Mines. Compensation figures do not include any hospital expense, because injuries are treated in a hospital operated by the company and no attempt has been made to allocate costs there between mine injuries and other service.

If there is a paramount requirement necessary to successful safety results it is that safety must become a part of the whole organization and must include the active interest of the directing head. Safety results cannot be expected if safety problems are left to "George." Accident statistics at Phelps Dodge mines are carefully compiled each month and forwarded to the general offices of the corporation. Each accident must be classified as to cause under one of the following heads:

TABLE I

Results of Ten-Year Safety Campaign

Year	Accident Frequency Rate	Accident Severity Rate	Tons Mined Per Lost-Time Accident	Cost of Compensation, Cents per Ton
1924	1.656	14.458	2,027	2.9
1925	1.490	14.084	2,162	3.9
1926	.829	9.672	3,334	2.7
1927	.550	10.909	5,841	1.4
1928	.313	13.025	11,081	2.1
1929	.133	4.869	27,328	1.2
1930	.168	6.510	21,630	1.4
1931	.055	7.108	61,208	1.5
1932	.120	.383	27,582	0.2
1933	.108	1.106	28,597	0.4

1. Fault of Injured Employee

(*a*) Accidents resulting from the use of tools, equipment, staging, etc., known to be defective or unsafe and not reported by the injured employee to his boss or foreman.

(*b*) Failure to use safety devices provided.

(*c*) Failure to use proper tools or appliances provided.

(*d*) Violation of safety rules or instruction.

(*e*) Improper act or selection of improper method of doing work (by workman).

(*f*) Failure to wear proper clothing or shoes.

2. Fault of Fellow Employee

Accidents caused by an act of an employee (other than a boss, foreman or other supervising officer at the time) under any of the foregoing causes [1 (*a*) to (*f*)], which results in an injury to a fellow employee.

3. Faulty Tools and Equipment

Accidents resulting from the use of tools, machinery and other equipment known to be defective.

4. Fault of Direct Supervision

(*a*) Failure to provide safety devices required.

(*b*) Failure to provide proper tools and equipment.

(*c*) Violation of safety rules by any one of supervising force.

(*d*) Improper act or selection of improper method of doing work by boss or foreman.

(*e*) Failure to instruct men as to the method of doing work and hazards incident thereto.

5. Fault of Indirect Supervision

(*a*) Accidents resulting from system of work or operations recognized now to be faulty.

(*b*) Accidents resulting from faulty design of plant.

6. Trade Risk

(*a*) Incidental and not reasonably preventable (act of God).

(*b*) Unavoidable risk of employment or conditions inherent in the work or occupation which cannot be reasonably foreseen or prevented.

Accidents are further classified as to character, such as falls, haulage, electricity, etc., as shown in Table II. These compilations are not red tape, but are necessary for intelligent consideration of the safety problem. A good safety record cannot be built upon guesses.

Safety work is conducted by a gen-

*Abstract of an address presented at the 32d regular meeting of the Rocky Mountain Coal Mining Institute, Denver, Colo., Feb. 26.

eral safety committee composed of the local operating officials, meeting not less than once each month and oftener if necessary. Minutes of these meetings are kept and copies exchanged with other branches of the company. The safety program is based on the following six steps:

1. Recognize Unsafe Practices

Probably the most important factor in recognition of unsafe practices is the inspection committee. This committee, composed of workmen and officials, with the workmen taking turns in serving on the committee, make monthly inspections of unsafe conditions and submit safety recommendations. These reports and recommendations are reviewed by the general safety committee.

Another means of uncovering unsafe practices is found in a study of all injuries—including no-lost-time injuries—with the committee constantly keeping in mind the thought of future safety, the removal of undetected hazards and the correction of poor practices. A very important influence has been the generous assistance and study of our problems by the U. S. Bureau of Mines. Too much credit can hardly be given the Bureau's recommendations in the development of our safety work.

2. Having Recognized the Unsafe Practices, Study the Jobs and Line Up the Safest Way of Doing Them; Standardize the Operation

Believing that there is a safe way of doing all work, constant effort has been made to standardize both the small and the large operations. This has been accomplished through special studies made by men familiar with equipment and actual operating conditions in and around the mines.

In this way, standard practice has been developed for timbering in main entries, cross-entries and rooms; in the installation of electric wiring and equipment; in track laying; as well as in numerous small operations, such as making a cap piece. It has been made standard practice to use a 4-ft. bar instead of a pick for pulling down rock or coal. The importance of mechanical safeguards and protective devices has been recognized. Safety hats, goggles and protective shoes are required, and their use has long been accepted as a matter of course.

3. Give Proper Instruction to All Concerned in the Practices Adopted

When a standard practice has been developed, the supervisory force is charged with the responsibility of instructing the men. A simple set of rules adapted to the Dawson mines has been the outgrowth of a period of years. A knowledge of these rules by officials and workmen is annually tested by examination.

Safety education for officials and men consists of first-aid training and retraining for all employees; first-aid contests, in which but one man to each team may have previously taken part; mine-rescue training and advanced mine-rescue training for selected employees; meetings of officials and employees to discuss safety measures and accidents; standardized safety procedure and mining practice. Posters are used to some extent to supplement instructions given orally.

4. Have Sufficient Supervision to Carry Out the Program

The supervisory force includes the mine foreman, fireboss and such other assistants as shall guarantee that each workman is visited in his working place at least twice during the working shift. Careful examination is made of working places, special hazards are pointed out, and the proper instructions are issued.

5. Place Responsibility Where It Belongs

There is an intense and insistent concern in safety matters by the highest officials of the company tantamount to a demand upon subordinate officials to eliminate all accidents. This means that management is forced to accept a larger measure of responsibility, and rarely may accidents be regarded as unavoidable. If investigation develops a means of preventing the recurrence of an accident, then supervision is at fault because of its failure to anticipate.

6. Then, Too, There Must Be the Strictest Discipline

Difficult as it may be to administer, rigid discipline of officials and men to secure observance of safety rules is maintained. The penalties vary, up to

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TABLE II

Classification of Lost-Time Accidents

1. BURNS
   - *(a)* Hot metal, explosives
   - *(b)* Miscellaneous
2. CONVEYORS
3. CRANES
4. CRUSHER ROLLS, GRINDING MILLS
5. PUMPS
7. ELECTRICITY
   - *(a)* Direct contact with trolley wire
   - *(b)* Tools striking trolley wire
   - *(c)* Contact with mining machine
   - *(d)* Contact with machine-feed wire
   - *(e)* Contact with haulage motor
   - *(f)* Miscellaneous
8. EXPLOSIVES
9. FALLS OF ROOF AND COAL
   - *(a)* At face of room or entry
   - *(b)* At face of pillar
   - *(c)* On entry
10. FALL OF PERSONS
    - *(a)* From scaffolds
    - *(b)* Miscellaneous
11. FALLING OBJECTS OR MATERIALS
12. FLYING OBJECTS (Including dust)
13. HANDLING MATERIAL
14. HANDLING ROCK, COAL, COKE
    - *(a)* Loading at face
    - *(b)* Digging at face
    - *(c)* Cleaning falls
    - *(d)* Miscellaneous
15. HANDLING TOOLS
16. HAULAGE LOCOMOTIVE AND RAILROAD
    - *(a)* Derail or collision
    - *(b)* Dumping cars
    - *(c)* Material falling from cars
    - *(d)* Miscellaneous
17. HAULAGE (Surface)
    - *(a)* Cars
    - *(b)* Change cars and motors
    - *(c)* Miscellaneous
18. HAULAGE (Underground)
    - *(a)* Switching and spragging
    - *(b)* Coupling
    - *(c)* Falling from trips
    - *(d)* Pushing cars
    - *(e)* Lifting cars
    - *(f)* Struck by train or car
    - *(g)* Between car and rib
    - *(h)* Between car and roof
    - *(i)* Derailments or collisions
    - *(j)* Runaway cars
    - *(k)* Animals
    - *(l)* Miscellaneous
19. MACHINERY
    - *(a)* Mining machines
    - *(b)* Scrapers
    - *(c)* Drills
    - *(d)* Pumps
20. MINE GAS OR POWDER SMOKE
21. NAILS AND SPLINTERS
22. SCALDING (Steam or water)
23. SHAFTS
24. STEAM SHOVELS

30. MISCELLANEOUS OTHER ACCIDENTS

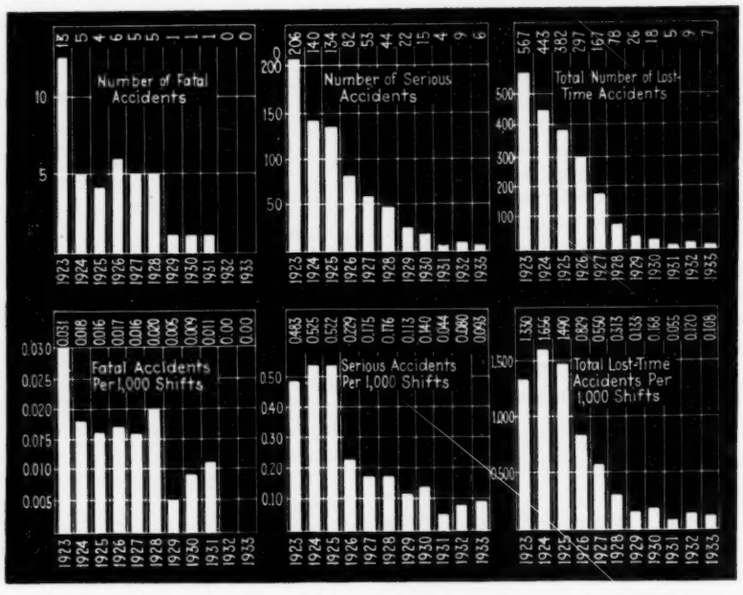

Number of Fatal Accidents
Number of Serious Accidents
Total Number of Lost-Time Accidents
Fatal Accidents Per 1,000 Shifts
Serious Accidents Per 1,000 Shifts
Total Lost-Time Accidents Per 1,000 Shifts

Fig. 1—How a Ten-Year Drive Has Brought Down Accident Rates.

MECHANIZATION

+ With Conveyors, Scrapers and Loaders

Discussed at Rocky Mountain Meeting

MECHANIZATION of underground loading by the use of shaking conveyors, scraper loaders and mobile loading machines had a large place on the calendar of the 32d regular meeting of the Rocky Mountain Coal Mining Institute, held at Denver, Colo., Feb. 26-28. The experience of two Wyoming producers furnished the text for addresses on the application of scrapers and conveyors; the modernization program recently undertaken by an Indiana operation brought the mobile type of loading equipment prominently into the picture.

P. H. Burnell superintendent, Owl Creek Coal Co., Gebo, Wyo., told how his company was advancing faces 25 to 30 ft. per day with shaking conveyors equipped with a self-contained power loading head. Developments in mechanization at the mines of the Union Pacific Coal Co., beginning with the use of Thew shovels twenty years ago and now centered on mining on the retreat with conveyors and scrapers, were traced by C. E. Swann, chief engineer of the company.

The Indiana story, covering the program of the New Hope mine of the Linton-Summit Coal Co., was brought to the Westerners by A. C. Green, central district manager, Goodman Mfg. Co. This program involves the use of track-mounted cutters and loading machines, special room-track layouts to eliminate delays in car changes, and mechanical cleaning for the minus 3-in. product.

The seam at Gebo, said Mr. Burnell, is opened on a 22-deg. pitch from the outcrop and is 7 to 9 ft. thick. The top is very soft and carries almost a foot of shale over the coal; top coal is now left in all places except haulageways to support the roof. Under the hand-loading system formerly employed, panels were driven 600 ft. apart and rooms were driven across the pitch. This system required a hoisting engineer and a rope rider on each panel and also the handling of cars in and out of the rooms.

Under the mechanical loading system now in effect, using shaking conveyors with the Burnell loading head, described in the February issue of *Coal Age* (Vol. 39, p. 46), three entries are driven across the strike on about a 1 per cent grade. The bottom entry serves as a haulageway and inlet for ventilation and the two top entries are used for the return (see Fig. 1). This is necessary, explained Mr. Burnell, because the seam "is of a fiery nature, both from the standpoint of spontaneous combustion and explosive gas." Rooms approximately 25 ft. wide and 250 ft. long are driven straight up the pitch, leaving a 25-ft. pillar. Only one entry is tracked and no rails are laid in the rooms, thereby effecting a substantial saving in transportation costs over the old hand-loading method.

Apricot Pits

How would you like to sell coal in competition with apricot pits—especially when the fruit stones are given away? That, as was brought out at the Rocky Mountain Coal Mining Institute meeting, is only one of the many sales hurdles the producers must face. And the institute itself is broadening its program to embrace merchandising objectives within its scope. The story appears on p. 135.

But the broadening process is being undertaken without sacrifice of interest in the more technical problems of the industry. Safety, as pp. 123 and 132 show, is still a major objective. And other operating problems are not being neglected; the same story that mentions apricot pits makes that clear.

Chutes are hung with chains. The drive is set at the bottom of the room, working three shakers abreast and delivering onto one shaker along the level through a crosscut to the central loading point. Each of these operations has a unit foreman or assistant who takes care of the entire operation. A cutting machine, an electric drill and a small hoist with a 1½-hp. motor for pulling material up to the face are necessary for each operation. All pans, timber and cutter-machine bits are hauled up the pan line by the hoist.

The loading crew consists of three men at the face and a motorman and a nipper at the loading end. Two men cut, drill and shoot while the third face man is getting the material together. Operation of each unit is confined entirely to one place until that place has been finished. The place is examined for bad top and gas before the men enter for work, before blasting and after blasting, before loading is started. The operation is double-shifted.

Mechanical loading, declared Mr. Burnell, helps cut down accidents because more skilled labor necessarily is employed and supervision is much closer where faces advance 25 to 30 ft. per day. With mechanized mining, "ventilation, sprinkling, rock-dusting and timbering require almost constant attention and supervision. This rapid progress in extracting the coal offers a safety measure also, because a uniform system of timbering is very essential. No miner is required to enter a place, as in hand loading, where the coal probably was shot down the day before and the top had been allowed to become loose."

While it might be asserted that shooting on the shift increased the accident hazard, such, the speaker contended, had not been the experience at Gebo. The Wyoming law makes the employment of qualified shotfirers mandatory and prohibits shooting where any danger may exist from improper timbering or in the presence of explosive gas. Since the enactment of that law, in 1929,

Gebo has not had a single accident chargeable to shooting. In the past eight months, working seven conveyors, there have been no accidents at the face and only one injury connected with loading since the mechanization program was started. That accident was caused by a piece of coal flying out of a chute and hitting a man standing near the loading end.

The New Hope mine, said Mr. Green, is 13 miles northeast of Sullivan, Ind., and is working the No. 5 seam, which averages approximately 6½ ft. in height. Part of the mine is hilly with grades running up to 8 per cent. The bottom is hard, and the top, except where slips occasionally occur, is so good that practically no timbering is necessary. Sixty-pound rail is used in the entries and 40-lb. in the rooms. The track is laid on good ties spaced close enough "to obviate the necessity of track repairs for a long time to come." Room track is laid to within 4½ ft. of the face.

Rooms are driven 24 ft. wide on 32-ft. centers. The coal is drilled with electric drills and undercut with Goodman track-mounted cutters equipped with 8-ft. bars. Loading is done with the new Goodman 260-A track-mounted machine served by reel-type gathering locomotives. Main haulage locomotives carry the coal to the slope bottom in 5-ton steel drop-bottom cars.

Greater capacity, lower upkeep and the fact that work is done on a day basis, he explained, have led to an increasing use of track-mounted cutters in Illinois and Indiana during the past five years. These machines can cut two to three times as much coal per shift as is normally cut by a shortwall machine. This trend in cutters dictated the development of track-mounted loaders with discharge conveyors built to suit the car height and the height of the particular coal seam in which they are to work.

During the first half of February, the loader at New Hope averaged 500 tons per shift. The highest day's run in that period was 545 tons; the lowest, 430 tons. The maximum has since been increased. On the day the time study used by Mr. Green in his address was made the machine loaded 510 tons. This time study is plotted in Fig. 2 and summarized in Fig. 3.

Out of the 480 minutes available, 314.45 minutes, or 65.5 per cent of the working time of the shift, was consumed in loading; 102.33 minutes, or 21.4 per cent, in switching; 43.6 minutes, or 9.1 per cent, in moving the loader; 13.8 minutes, or 2.84 per cent, in track delays; 3.6 minutes, or 0.73 per cent, in loader delays, and 2.2 minutes, or 0.43 per cent of the total time, was lost because of power failure. Forty per cent of the loading time, or 126.5 minutes out of 314.45 minutes, was spent in digging and cleaning up.

In plotting this time study (Fig. 2), each "X" indicates the loading of a 5-ton car. The first few cars are loaded out quickly, but, as the loader begins to dig down the standing shots, the time required to load out a car increases materially. Mr. Green estimated that fully 80 per cent of the 126.5 minutes charged to digging and cleaning up was consumed in digging only. Mine management should strive to reduce digging time to raise the tonnage per shift per loader.

One of the rooms at New Hope has been equipped with a 4-rail 3-track layout which the management plans to use extensively. In this layout (Fig. 4), four rails are laid to gage with the inside rails extending 6 to 10 ft. beyond the outside rails. Both the cutter and the loader operate from the inside rails. When the loading machine enters a room, an empty and a locomotive are spotted on each outside track. When one car is loaded, the loading machine operator immediately shifts the discharge conveyor to the second empty and the loaded car is hauled to the parting.

Since the distance between the cars is only about 6 in., as a rule the operator does not shut off the discharge conveyor when shifting it from the loaded to the empty car. The spillage is so slight that this loss does not offset the increased tonnage loaded by this system. Mr. Green indicated, however, that some provision probably would be made to eliminate the spillage loss. On the day the time study was made, the maximum switching delay in the room with this track layout was less than one minute and there were several car changes without delay. The first eight cars were loaded in 20.6 minutes, or at a rate of approximately 2 tons per minute.

In this particular layout, the distance between the outside rail and the pillar is 6 ft. The pillar is 8 ft. thick, so that it is possible for the cutting machine with its 8-ft. bar to almost cut through the pillar from one side. It can be done easily from both sides. By reaching 12 ft. from the outside track, the loading machine can reach half way through the pillar from each side. In this way, the breakthroughs between rooms can be cut and loaded out.

The loading crew of thirteen men includes a loading-machine operator and helper. The time of the latter is spent largely in loosening coal at the face and in taking care of the cable when moving from place to place. The loading machine has a spring-operated reel with a stop on the cable. Near the stop is an anchor. When the machine reaches the coal and is ready to start loading, the anchor is thrown overboard and the cable is kept tight by the spring as the machine moves back and forth on the track. Before the machine was so equipped, the greater part of one man's time was employed in watching the cable. The anchor idea was worked out by the loading-machine operator at the New Hope mine.

The complement of the loading crew is: one loading-machine operator at $6.75 per day; one helper at $6.75; two cutting-machine men at $6.75 each; two

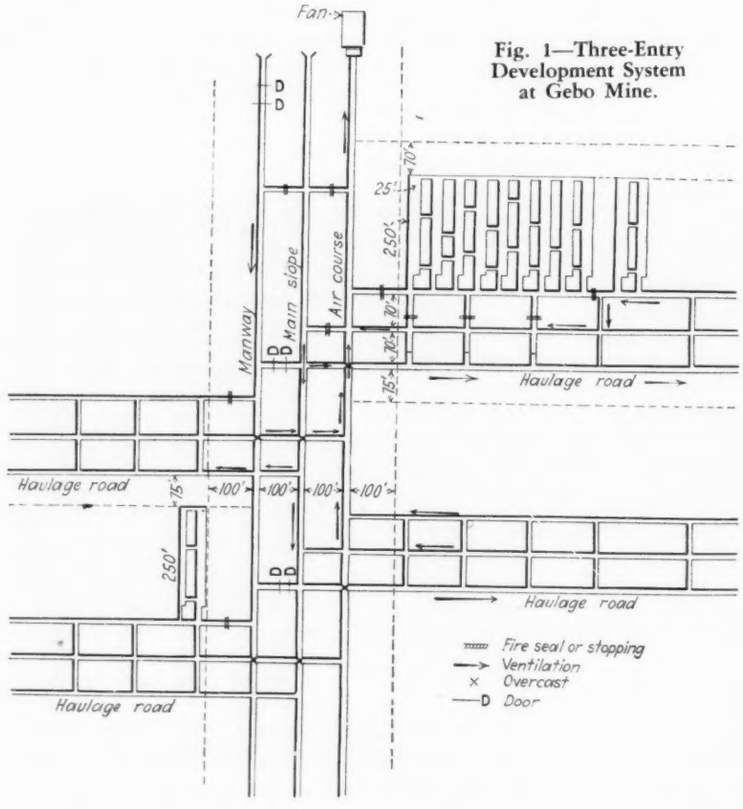


Fig. 1—Three-Entry Development System at Gebo Mine.

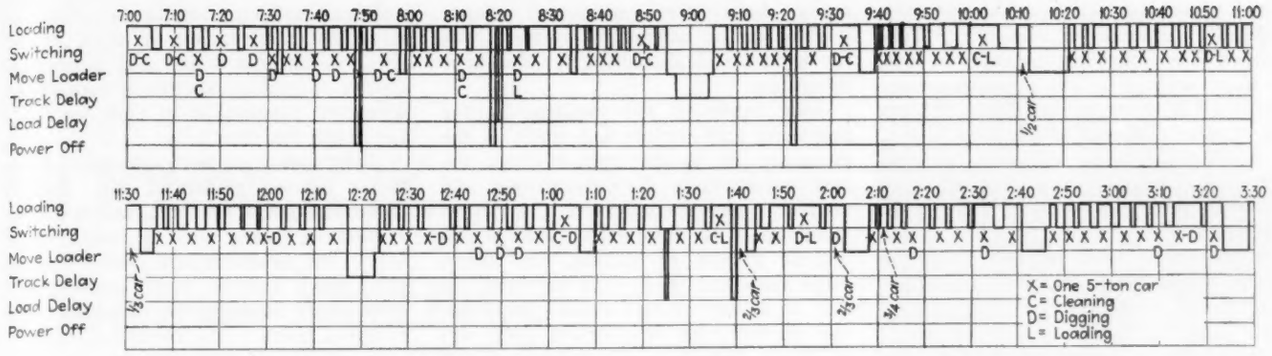


Fig. 2—Time Study of Day's Loading-Machine Operation (Lunch Period, 11 to 11:30 A.M., Not Shown).

drillers at $6.15 each; two motormen at $5.14 each; two trackmen at $4.57 each; two snubbers at $6.15 each; and one trip rider at $4.69 per day. This makes the total wages chargeable to the loading unit $75.71 per day.

A variation of the New Hope room-track layout is planned for the Peerless mine, controlled by the same interests. There it is proposed to use a 6-rail 3-track layout (Fig. 5). In this layout, two tracks are first laid on

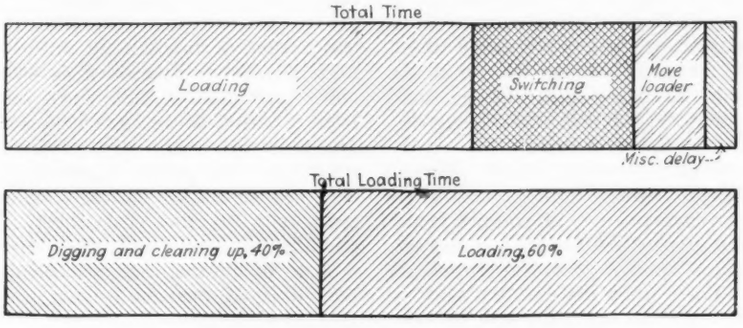


Fig. 3—Summary of Loading-Machine Time Study at New Hope.

centers which can clear two cars; the third track is laid with the rails coming inside the other two tracks. The third track extends some distance beyond the outer tracks.

Space for a car and a locomotive from the latches to the ends of the outside tracks is required. As in the New Hope layout, two empties with a locomotive at each will serve the loading machine on the inside track. From the latches to the end of the center track the tracks are so constructed that after each fall the entire length can be pulled to the face with a jack pipe and a cable attached to a locomotive. Ball rails will be used to fill in until the assembly can be moved up a rail length.

If full advantage is to be taken of tonnage possibilities in machine loading, Mr. Green pointed out, no time can be wasted in cleaning coal at the face. At New Hope, mine cars dump the coal into a double hopper at the foot of the slope and a duplex feeder delivers the coal from the hopper to an inclined scraper conveyor which discharges on the raw-coal screen in the cleaning plant. Lump and egg go to picking tables for hand cleaning and the minus 3-in. is delivered to a Norton wash box.

After washing, the minus 3-in. is screened into nut, pea and slack. The two larger sizes then go to loading booms, while the slack is dewatered over ½-mm. wedge-wire screens. The dewatered slack is then discharged onto a belt conveyor which carries the coal either to the slack loading boom or to a mixing conveyor which runs across all loading tracks at the ends of the booms. A lump-coal crusher is located between the runs of the mixing conveyor; the crushed product can be loaded directly into railroad cars, combined with other sizes or returned to the raw-coal screen for resizing.

Pure refuse from the picking tables is conveyed to a refuse bin. Middlings travel by a separate conveyor to a rotary crusher and the coal product is delivered to the Norton unit for re-treatment. Water with suspended fines from the dewatering screens is collected in a sump and then pumped to an elevated conical tank where the solid fines settle to the apex of the cone and are drawn off and re-dewatered over ¼-mm. screens. Fresh-water sprays are mounted over the classifying and dewatering screens to remove any wash-water impurities from the coal before shipment.

Successful operation of a mechanized plant calls for an operating personnel that is mechanically minded and that will give close attention to the proper coordination of all the mechanical equipment both underground and on top. New Hope, from its president, John A. Templeton, dean of the Mid-Western operators, down, declared Mr. Green, has such a staff.

Although mechanical loading at Union Pacific mines started in 1914 with Thew shovels at Hanna, Wyo., this equipment, said Mr. Swann, was practical only in high coal and on comparatively level surfaces. In the search for a method which might prove successful for mines operating in pitching seams where the cover increased rapidly as the workings advanced down the dip and where roof became tender after passing the surface-water level, the management decided to try out shaking conveyors and scraper loaders.

Experimental work with conveyors was launched at the Superior mines in 1925 when a block of coal was split by driving a pair of narrow places up the hill connecting with the entry above and plans were laid to recover 60 ft. of the pillar on each side by slicing it along the strike line. Mechanical difficulties in the operation of the equipment selected were overcome and the duckbill loading head was perfected to eliminate hand shoveling. But roof troubles also developed as soon as any large area was worked out, with rock falls passing over the face timbers, spoiling the working face and making necessary the recovery of the face by hand while the equipment stood idle. This method of mining, therefore, was abandoned in favor of an advancing room-and-pillar system with shaker-conveyor loading.

The type of roof—heavy cover and many blocks of coal only partly removed in the upper hand-worked part of the mine—combined to carry the roof stresses over the lower workings and make the operation of scrapers impracticable. A three-entry system with the center entry driven wide and allowed to cave to relieve roof stresses over virgin territory was considered, but not tried out. Instead, a pair of entries were driven to a property line and an experimental section was laid

out for a trial retreat shaker room-and-pillar system of mining. "This system," continued Mr. Swann, "is now common practice at the Superior mines and is giving excellent results both from the mining and cost standpoints."

While this system was being worked out at Superior, a trial was made of the V-system for scraper loading at the Rock Springs No. 8 mine. This experiment showed promise "until a fairly large block of coal had been worked out, when frequent falls of roof rode over the breaking line of props, putting the face out of commission until it could be recovered by hand methods." The next experiment involved slabbing a face parallel to the dip line.

Experimenting further with scraper loading, blocks of solid coal approximately 138 ft. wide were developed with shaking conveyors by driving 14-ft. places uphill between entries on 160-ft. centers. It was planned to load out 80 to 90 ft. of the blocks with scrapers, leaving about 50 ft. between blocks to be removed by conveyors. With the limited number of shaking-conveyor units then available, said Mr. Swann, it was impossible to maintain development and remove the blocks between scraper places fast enough to relieve roof thrust. New blocks, therefore, were laid out on 100-ft. centers and an attempt was made to work all the blocks with the scraper loader. Timbering costs, however, proved to be excessive, so the present system of turning places on 80- to 85-ft. centers with a sacrifice pillar 8 to 10 ft. wide between scraper places was adopted.

Scraper loading to recover coal for railroad use had shown such possibilities that the combination of shaking-conveyor development and scraper-loader recovery of the blocks appealed strongly to the Union Pacific management. Working this system advancing, it soon became apparent that, when several parallel entries were in operation, it would be necessary to drive a four-entry system of development in order to leave intact the haulage entry and the aircourse at each entry until the workings could reach the property line. "This system left about 40 per cent of the area worked over in these development blocks which was coal that did not lend itself to easy recovery by mechanical loading."

Roof control also entered the picture. Inability to withdraw the large blocks of coal left in the development quickly enough to control the direction of roof thrust, which was being transmitted from the block of coal left by the four-entry development system on one entry to similar blocks left on entries farther down the pitch, threatened a squeeze which would cross the main slope and endanger the life of the mine. Despite very attractive mining costs, the conclusion was reached that the combination shaker development and scraper loading on an advancing system "was far from an ideal method for this type of mining."

Joint study of the problem by the operating and engineering staffs of the company led to the opinion "that the best results from shaker-conveyor and scraper-loader mining over a series of years could be obtained only by a full retreat system of mining, or, where large coal-land areas were involved, the use of a semi-retreat system in which the territory to be worked over was split into definite sized blocks in which the full retreat system could be applied. This recommendation involved a radical departure from usual practice, while the ultimate result was not determinable for a comparatively long period."

In line with this recommendation, the advance system was discontinued on the lower entries of the No. 8 mine in 1930 and development work on these entries was speeded up so they could be driven to a property line approximately 3,000 ft. from the main slope. By the winter of 1930-1931, the retreat system of mining with conveyors and loaders or with conveyors only "had thoroughly established itself from every angle as a distinct improvement over the advancing system formerly used. The No. 8 mine was on its feet again and able to carry the tonnage load while another old mine was being revamped for the new system.

"Systematic planning strictly adhered to, except where mining conditions dictate a change, is a substantial factor in making the retreat system a success. The plans should provide for definite retreat lines, leave little or no work to be done by hand methods, provide control entries for regulating the air movements and caring for mine drainage. A definite long- and short-haul system of haulage should be established wherever practicable to equalize haulage loads and costs."

Maintenance of uniform spacing between entries, continued Mr. Swann, is desirable, but difficult to achieve in a pitching seam with a rolling floor line. The resultant bad grades demand good track layouts, some grading and motorized haulage to maintain the required speed. The scraper equipment uses 2,300-volt a.c. power; conveyor and motor haulage units operate on 250 volts, d.c.

With good roof and floor and a relatively clean seam, one scraper can load out as much as three shaker units; under bad roof conditions, conveyor mining is more practicable. In figuring scraper-loading costs, however, the added cost of the shaker-conveyor coal made necessary in developing entries and uphill places for the scrapers to operate should not be overlooked.

Due to the rigid control over roof action possible under the retreating system, said Mr. Swann, that system results in: (1) better safety, (2) improved haulage over long periods, (3) less upkeep in maintaining active workings, (4) better control of development work with less of this work required over a period of years, (5) less track, (6) better recovery, (7) profitable recovery of coal under a greater cover, and (8) intangible savings which appear only in the cost sheet. "The cumulative results of the retreating system of mining are a reduction in cost of coal recovered from the area allotted to the mine."

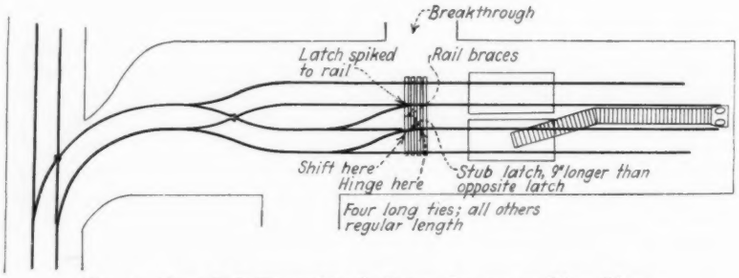


Fig. 4—Four-Rail Three-Track Room Layout at New Hope.

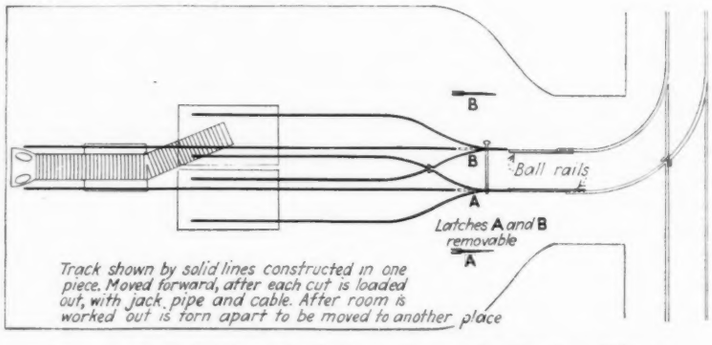

B
B
A
Ball rails
Latches A and B removable
A
Track shown by solid lines constructed in one piece. Moved forward, after each cut is loaded out, with jack, pipe and cable. After room is worked out is torn apart to be moved to another place

Fig. 5—Six-Rail Three-Track Room Layout for Peerless Mine.

LILLYBROOK

+ Generates Mine Power

At New Non-condensing Plant

The Plant Is Located in the Town of Lillybrook and Near the Mine Portal.

IN SEPTEMBER, 1933, the mine load of the Lillybrook Coal Co., operating in the Winding Gulf smokeless field of southern West Virginia, was shifted from the utility power line to a new steam-power plant built by the coal company at Lillybrook. The total cost of this generating plant was approximately $125,000. The design is unusual in that it is non-condensing and yet, for that type of plant, it lacks nothing in modern equipment to insure reliability, reduce labor, promote fuel economy and assure low maintenance.

The company was producing up to 1,000,000 tons of coal per year and spending up to $65,000 per year for electric power. Kilowatt-hours consumed per month sometimes exceeded 400,000 and the 15-minute monthly maximum demand ran from 700 to 1,000 kw. Several years ago the coal-company executives began to give serious consideration to the possibility that building a mine power plant would effect a large saving in the cost of electricity. In the meantime there was a rate reduction of 25c. from the monthly demand charge of $1.50 per kilowatt. Figured on the basis of power invoices for the three previous years, however, this was not sufficient to delay further consideration of a power-plant project.

Favorable to a power plant was the condition that the mines are drift operations and are devoid of large hoist motors, which would impose high peak loads. The water situation was this: The only continuous supply available for a power plant was a stream of 2,000 gal. per minute draining from a mine. A sample was sent away for analysis and the opinion received that the water was fairly low in scale-forming ingredients but might require treatment to prevent foaming and corrosion. It was calculated that the minimum flow was not sufficient for cooling water to operate a condensing plant unless storage facilities were provided or a cooling tower or spray pond was included in the plant equipment.

The fuel would be principally marketable coal consisting largely of machine cuttings, but track cleanings and reject coal also would be sent to the boiler plant. Mine-run would be used when sufficient cuttings were not available. The coal mined is a low-volatile smokeless from the Fire Creek seam. An analysis from this seam shows moisture, 2.4; volatile, 16; fixed carbon, 76.7; ash, 4.90; sulphur, 0.65; and heat units, 14,900. The ash-fusion temperature is approximately 2,800 deg F.

Power consumption of the mines, including house lighting, averages 3.85 kw.-hr. per ton. After the reduction in demand rate went into effect, the power cost ran approximately 1.3 to 1.4c. per kilowatt-hour, depending on running time. The fan and pumping base load is about 200 kw., and the peaks reach 1,500 kw.

Determining the size of plant to install called for careful investigation of peak loads and a forecast of the future. In order to reduce initial investment, it was decided to hold the present capacity to a minimum but make certain provisions for a possible future increase in capacity.

The installation consists of two 750-kva. engine-driven alternators and two 507-hp. stoker-fired boilers with full-automatic control. Nothing but brand-new equipment was used. Engines are the Skinner Universal Uniflow central-exhaust type. They are single-cylinder, horizontal side crank, floating-piston design with auxiliary exhaust valves and rated 960 i.hp., 150 r.p.m., 165 lb. pressure, 25 per cent overload capacity, non-condensing. Each engine is equipped with an individual automatic lubricating system.

Direct-connected alternators of welded design are rated 750 kva. (600 kw. at 80 per cent power factor), 40 deg. C. rise, 150 r.p.m., 3 phase, 60 cycle, 2,400 volts, 25 per cent overload capacity. Exciters driven by multiple V-belts from the alternator shafts, are rated 20 kw., 40 deg. C. rise, 850 r.p.m., 125 volts, 25 per cent overload capacity. Normal field current to be supplied by each exciter is 135 amp.

Steam consumption of the generating units in approximate figures, as supplied by the engineering company which furnished the entire equipment of the plant, is as follows: pounds of steam per kilowatt-hour generated, 33.5 at 150 kw. load, 28.2 at 300 kw., 28.2 at 450 kw., 30.2 at 600 kw., and 32.5 at 750 kw. This flat steam-consumption curve is a highly desirable feature for the highly fluctuating loads encountered at a mine.

Boilers are Stirling Type H. These have three fusion-welded drums; they present 5,070 sq.ft. of heating surface, are built for 180 lb. working steam pressure (but operated at 165 lb.), are 24 tubes wide and are set with the center line of the mud drum 12 ft. from the floor. The flange of the steam nozzle stands 23 ft. above the floor. Superheaters are not included but the boiler design is such that most of the top group of tubes operate dry.

Each boiler is equipped with a three-unit motor-driven RotoStoker. Stationary grates used in connection with the stokers are set on a level and each comprises 96 sq.ft. of combustion surface (12 ft. wide and 8 ft. front to back). With this type of stoker the coal is thrown, by rotors, upward and into the furnace in a manner which

can be adjusted to provide even distribution from front to rear. The fine particles are burned in suspension, which fact aids the equipment in meeting the sudden fluctuations of mine load. Below each rotor and at grate level is a full-sized firedoor. Fires are cleaned through these doors, and in case of an emergency or a lack of power, as in starting the plant from cold, they can be used for hand-firing. The load can be carried by two units of the stoker while the third is shut down for cleaning the grate. The combustion chamber has a mean height of 12 ft. to the lowest tubes. Each stoker is driven by a 2-hp. constant-speed induction motor.

Combustion is by a combination of forced and natural draft and is automatically controlled. The reinforced-concrete stack with 40-ft. brick lining is 178 ft. 6 in. high and is 6 ft. 6 in. internal diameter at the top. For each boiler there is provided a forced draft fan, size No. 32, Type HSV, direct-driven by 17-hp., 1,500-r.p.m. two-stage Whiton steam turbines.

The Hagan automatic control of steam pressure operates as follows: Changes in the steam pressure on a control diaphragm operate valves which cause compressed air to move a piston, thereby rotating slightly, or rocking, a power shaft. This movement changes the length of stroke of the stoker feeders, swings the damper valves in the ducts between fans and ashpit, and changes the steam-throttle openings of the blower turbines. Another Hagan controller maintains constant pressure in the combustion chamber by adjusting the stack damper. Each boiler has its own master controller for this regulation, but for the steam-pressure regulation one master controller serves both boilers.

Water level in the boilers is regulated automatically by Bailey equipment. The action is to regulate the opening of a valve in the high-pressure feed-water line. The resultant change in water-line pressure acts on a Bailey governor to control the speed of the pumps. Two Worthington 10x6x12-in. duplex piston-type feed-water pumps are provided.

Back pressure of the engine exhaust in the feed-water heater also is automatically controlled. A 20-in. butterfly valve in the atmospheric exhaust line is operated by compressed air piloted by a low-pressure master controller. The 1,500-hp. Elliott open-type cylindrical cast-iron feed-water heater is so mounted that its water level is 12 ft. higher than the feed-pump cylinders. The feed-water temperature is kept at 212 deg. F.

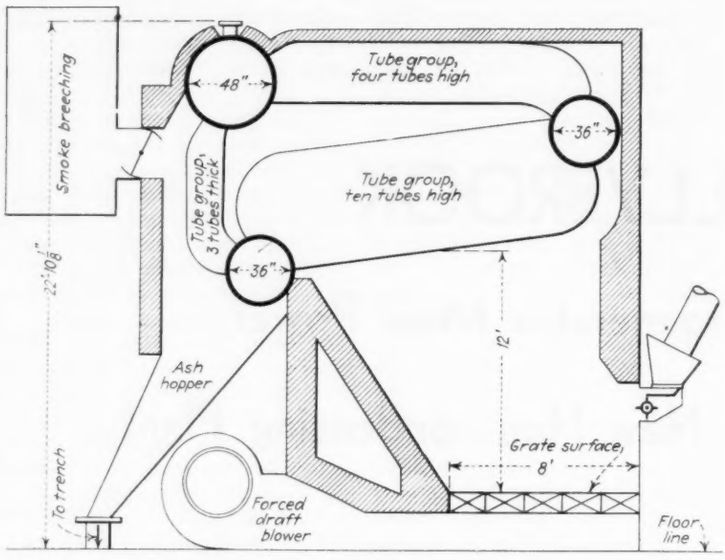
Still another boiler-room feature is automatic. The blow-down is by a Tret-O-Meter. This device consists of a water meter in the raw make-up line, which meter, by gearing attached to the register, operates a pilot valve in an air line and supplies compressed air to operate a reciprocating pump-type measuring valve that controls the boiler blow-down. The amount of blow-down is proportionate to the amount of boiler feed. Since the meter is equipped with recording dial, it can be used to supply an approximate check on plant performance. The water thus metered represents approximately 90 per cent of the boiler evaporation. Since the coal is weighed as delivered in mine cars and the generated kilowatt-hours are metered, plant efficiency for periods of a month or more can be determined with fair accuracy.

Water treatment is introduced by manual control from a 6-gal. preparation tank connected to the feed-pump suction line. The treatment is "Hagan-Phosphate," used in amount as directed by tests made or supervised by the Hall Laboratories.

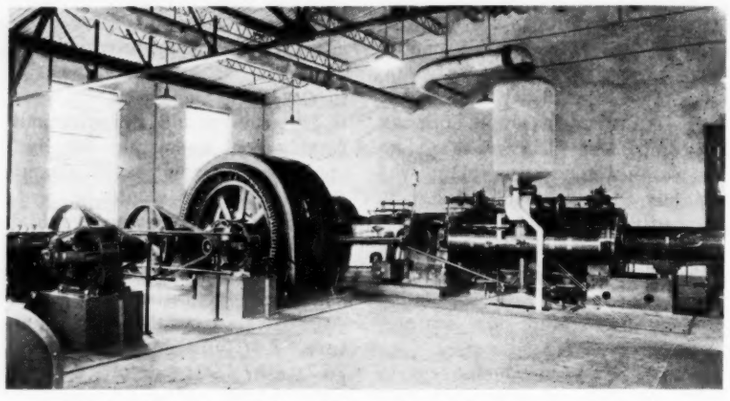
Each boiler is equipped with an 8-in. non-return valve and with valve-in-head, five-element, Diamond soot blowers. The steam-line arrangement consists of 8-in. lines from each boiler to a 14-in. header and 8-in. lines from this header to each engine. The header is not extended into the engine room but is confined to the boiler room, and the two steam lines to the engines are carried through the division wall at points on the same level and about 4 ft. apart. Where convenient, the 8-in. lines were acetylene welded. The remainder of the steam-line connections are VanStone flanged joints. Pipe covering is 85 per cent magnesia, 1½ in. thick.

Coal-storage space of 72 tons capacity is provided by an elevated steel bunker 11 ft. wide, 32 ft. long, and 10 ft. deep, made of ¼-in. steel plate and supported on six 8-in. H columns. Coal is delivered into the bunker by a 24-in. belt conveyor 136 ft. long between centers. A rotary dump, single-roll crusher and apron feeder were installed on a slate track that extends along the hillside near the power house. The belt conveys the coal directly from this feeder to the bunkers.

Fine ash from the rear of the boiler and from the base of the stack is sluiced to the creek through a covered trench and duct serving the ash hoppers located at the rear of the boilers, and passing by the base of the stack. Cin-



Approximate Sketch of Boiler and Equipment.



The Exciter of a Duplicate Generating Unit Shows at the Left.

ders from the grates are wheeled out.

The boiler-room section of the power-house building was made large enough to accommodate two more boilers of the same capacity, but this extra space is to serve as a central machine shop until, if ever, extra boilers are to be installed. If additional engine capacity is provided later, it is the plan to build an extension onto the end of the engine room. The boiler room is 30 ft. high to the eaves, and the engine room 16 ft. Both are 50 ft. 8 in. wide. The engine room is 49 ft. long, and the boiler room 84 ft., including the machine shop space. For the present boiler capacity a length of 44 ft. would have sufficed.

Construction is steel framework, steel sash and doors, coke-breeze concrete block walls 8 in. thick, Truscon "Bar-Joists" for purlins, ½-in. corrugated asbestos roofing, and asbestos ventilators with concrete bases supported on the steel structure.

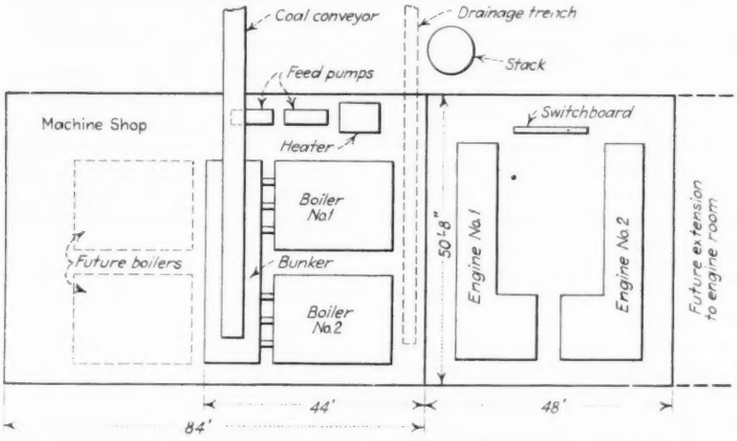
The power project included a 40,000-gal. steel tank set on a hillside at an elevation 112 ft. above the power-house floor level. From a sump in the mine, water is forced up to the tank by a 250-g.p.m. centrifugal pump automatically controlled by a Mercoid float switch. This water is used for the boiler feed, for sluicing ashes, and for general purposes about the plant.

The plant switchboard, installed in the engine room, consists of a swinging bracket, one regulator panel and one control panel for each generator, and five feeder panels. Mounted above the panels, which are made of 1½-in. ebony asbestos, are the disconnecting switches and an electrostatic ground detector. Voltage regulators are the Brown-Boveri rocking contact type. Instruments mounted on the swinging bracket are a synchroscope, two voltmeters and a frequency indicator. One of the generator control panels carries an engine-speed control switch. The other has none, because it suffices to have but one engine fitted with the motor-driven governor adjustment.

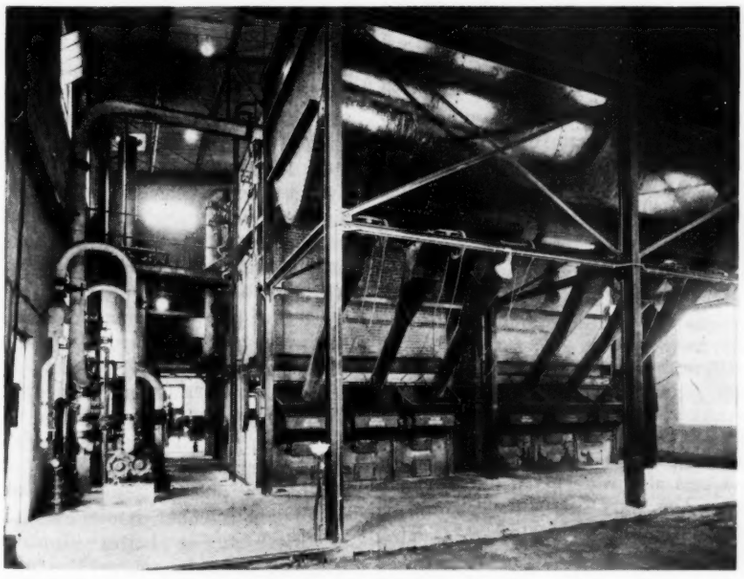
A normal operating crew for the plant consists of two men, but this is varied during the 24 hours by using but one man during certain hours and three men during certain other hours—for instance, when dumping coal and filling the bunkers or cleaning fires.

As to over-all efficiency, calculated monthly from coal weights and meter readings, the plant has been operating consistently on less than 5 lb. fuel burned per kilowatt-hour generated. The best figure was 4.18 lb., or approximately 62,500 B.t.u. per kilowatt-hour—an over-all thermal efficiency of 5.5 per cent. Operation of a non-condensing mine power plant on less than 5 lb. per kilowatt-hour is exceptional performance. A favorable factor at Lillybrook is a very high load factor. The mine loads have been distributed over the 24 hours. Even at night the load is so high that it is necessary to operate both generating units.

The equipment was designed by power-plant engineers working in conjunction with officials of the Lillybrook Coal Co. J. B. Clifton, of Beckley, president of the coal company, gave his personal attention to the design. J. A. Hunt, general superintendent; J. W. Ailstock, mine superintendent, and C. H. Farmer, mining engineer, all of Lillybrook, also were concerned with design and erection of the plant.



Showing Approximate Floor Dimensions and Indicating General Arrangement of Equipment.



View of Boiler Room From Machine-Shop Space.

Lillybrook Equipment Log

Engines	Skinner Engine Co.
Alternators, exciters, switchboard, oil switches, stoker motors	General Electric Co.
Voltage regulators	Allis-Chalmers Mfg. Co.
Boilers	Babcock & Wilcox Co.
Stokers	Detroit Stoker Co.
Furnace brickwork	Rust Engineering Co.
Chimney	Alphons Custodius Chimney Construction Co.
Soot blowers	Diamond Soot Blower Co.
Feed-water regulators, pump governor	Bailey Meter Co.
Boiler non-return valves	Golden-Anderson Valve Mfg. Co.
Tret-O-Meter	Proportioneers, Inc.
Forced-draft fans	Clarage Fan Co.
Forced-draft fan turbines	D. E. Whiton Machine Co.
Combustion control, and back pressure control with butterfly valve	Hagan Corporation
Steel bunkers	Virginia Bridge & Iron Co.
Rotary dump and apron feeder	Kanawha Mfg. Co.
Coal crusher	Jeffrey Mfg. Co.
Feed-water heater	Elliott Co.
Boiler-feed pumps	Worthington Pump & Machinery Corporation
Valves and piping	Crane Co.
Pipe covering, asbestos roofing, asbestos ventilators	Johns-Manville Corporation
Piping contractors	Peck, Hannaford & Peck Co.
Feed-water conditioning	Hall Laboratories
Building steelwork fabrication	Truscon Steel Co.
Conveyor belt	Goodyear Tire & Rubber Co., Inc.
Idlers for conveyor belt	Morrow Mfg. Co.
Conveyor motor	General Electric Co.
Feeder motor	General Electric Co.

SAFETY MAKES GAINS

+ With Increased Mechanization

In Rocky Mountain States

DEFINITE PROGRESS in accident reduction in the coal industry of the West was reported at the 32d regular meeting of the Rocky Mountain Coal Mining Institute, held at Denver, Colo., Feb. 26-28. Increased mechanization, with the greater supervision demanded for successful operation under mechanical loading, was cited as one important factor in the diminishing toll of injuries and deaths. The use of protective clothing and goggles was credited with decreasing the number of head, foot and eye accidents.

Topping and embracing every other cause for improvement in the records of individual companies was an unbending will for safety dominating management and extending down and throughout the organization. This was emphasized by Gilbert C. Davis, manager, Stag Canon branch, Phelps Dodge Corporation, in telling how the Dawson mines, although handicapped by dangerous natural conditions, had reduced accident-frequency rates from 1.656 to 0.108 and severity rates from 14.458 to 1.106 since 1924. The same idea was stressed by J. P. Russell, general safety inspector, United States Fuel Co.

More progress was made between 1924 and 1933 than in any preceding ten-year period, asserted David K. Wilson, Deputy Inspector of Coal Mines for the State of Wyoming, whose review of the accident experience of his State followed the presentation of Mr. Davis' review of the ten-year record at the Dawson mines, summarized on page 123 of this issue of *Coal Age*. During the same period, said Mr. Wilson, fatalities in Wyoming had dropped from 64 to 9. Non-fatal accidents also had shown a gratifying decline, but there was room for still further improvement, particularly in the matter of eye injuries.

In 1925, he continued, the ratio of fatal accidents per 1,000 men employed was 2.5; the number of tons per fatality was 409,848. Three years later the ratio was 5.2 and the tonnage, 262,127; by 1931 the ratio had dropped to 2.99 and the tonnage was 357,168. In 1932—Wyoming's banner year in safety—the ratio was 1.41 and the tonnage was up to 694,736; last year the figures were 2.37 and 444,956, respectively.

Reduction in fatal accidents from roof and coal falls since 1928 (see Table I) was attributed to mechanization, closer supervision, more effective and systematic timbering, better illumination and stricter inspection. Concentration, wider and cleaner roadways, better illumination and rock-dusting, Mr. Wilson stated, were responsible for decreases in haulage fatalities: the shot-firers' law of 1929 cut the toll on fatalities due to explosives. In 1933, he added, 71.9 per cent of the output of the State came from rock-dusted mines and 73.5 per cent from operations using electric cap lamps.

The same factors which helped reduce fatalities also contributed to a reduction in non-fatal accidents (see Table II) during the period under review. In addition, said Mr. Wilson, credit also must be given to the use of shatter-proof goggles, protective headgear and hard-toed shoes. Prior to 1928, full reports on non-fatal accidents were not made to the State. "This undoubtedly accounts for the higher number of accidents shown in 1928 over preceding years."

Illustrating the possibilities of eye protection, Mr. Wilson reported that one company which made the wearing of shatter-proof goggles compulsory for all men in 1932 and which had had some men equipped with screen goggles as early as 1930, cut eye injuries from 29 in 1930 to 8 in 1931, 5 in 1932, and 2 in 1933. The two injured last year were not wearing goggles at the time of their accidents. Another company employing only one-tenth as many men had 11 eye accidents in 1930, 1 in 1931, 2 in 1932, and 5 last year. This second company does not require its men to wear goggles.

About 60 per cent of the Wyoming miners wear protective hats and about 50 per cent are required to wear goggles at their work. The percentage wearing hard-toed shoes is small. "With the universal adoption of all three safety measures," he declared, "I am confident that a large portion of our lost-time injuries would be prevented."

The past three years has witnessed too many accidents due to falling and flying objects, mechanical loaders and mining machines. Mr. Wilson believed, however, that accidents in these categories will be materially reduced as workers become more experienced in the use of their machines and dangerous operating practices are eliminated.

"As I see it," he concluded, "the reasons for reduction in accidents in Wyoming are: Concentration and reduction in working places, with resulting closer supervision—both due to mechanization; systematic timbering; wider and cleaner haulageways; rock-dusting, causing better illumination—not forgetting, of course, the prevention of propagation of explosions; also better

Safety First!

Safety always has had a prominent place on the program of the Rocky Mountain Coal Mining Institute. The 1934 winter meeting was no exception. In addition to the safety papers reviewed in the present story and the address by Gilbert C. Davis abstracted on p. 123, safety also came into the picture in the discussions on mechanization—particularly, as told on p. 125, at Gebo.

Safety, however, was not the sole topic at the Denver meeting. Other operating problems and the economic situation as reflected in code government and new merchandising problems also were given consideration. The story of these phases of the meeting appears on p. 135 of this issue of *Coal Age*.

illumination and prevention of gas ignitions through the use of late models of the electric cap lamp; use of the protective hat, hard-toed shoe and shatterproof goggles; compliance with State mining laws; stricter inspection and compliance with all safety rules which are laid down by the individual companies; and the education of the workman so that he may be made to realize that all these preventive measures are taken and are necessary for his and his buddies' safety."

Reports on accidents due to falls, which account for over 50 per cent of the fatalities in Colorado mines, declared Robert F. Dalrymple, inspector, Employers' Mutual Insurance Co., invariably show that the foreman visited the place an hour or two before the accident, that he found the place timbered in accordance with the terms of the agreement between the mine and the State Mining Department, that he considered the place safe or ordered timbers set to overcome some unusual condition, but did not stay to see the additional timbers actually set. Generally, too, he relied on the appearance of the roof and did not test it with the proper tool.

Because the miner is primarily responsible for timbering, "he should be thoroughly instructed as to how the timber should be set and when it shall be set. The time that the timber is set is just as important as the distance between timber. Timber should be set at specified distances (the maximum distances between timbers and between timbers and the face are covered by the agreements between the State and the individual mine) as the coal is being loaded and not after the working place has been cleaned up. If the foreman decides that extra timbers are necessary, he should see that they are set immediately or penalize the miner if the miner refuses to set them. Roadhead props should be set before starting to load coal where the roof is loose or dangerous and in no case later than when the halfway point is reached between the last roadside post and the face."

Enforcement of timbering regulations is largely a matter of training and discipline, but it must have the active support of all the operating officials of the company to be successful. With such enforcement "it will not be necessary for the foreman to spend any more time in the working place than he does now." What this enforcement means was illustrated by the record of one producing company that reduced fatal accidents from falls from 9 in 1927 to 2 in 1931 and had no deaths from falls in 1932 (see Table III).

Mr. Dalrymple contrasted this with the record on lost-time accidents of a second company which had a systematic timbering program but did not discipline its men for non-observance of the program until 1931. In 1929 this second company had 9 lost-time accidents chargeable to falls of roof and coal with an average of 51 days lost per accident and a tonnage of 16,303 per accident. The following year accidents increased to 16, tonnage per accident fell to 7,881, and days lost jumped to 132.12. There was no decrease in the number of accidents the next year and the tonnage per accident was slightly lower, but the days lost per accident declined to 91.12. In 1932, accidents fell to 5, the tonnage per accident rose to 18,048, and the days lost per accident fell to 39.6.

Table I—Coal-Mine Fatalities in Wyoming

Year	Falls	Haulage	Explosives	Total*
1924	19	11	3	73†
1925	10	3	3	16
1926	13	5	1	21
1927	15	2	1	22
1928	18	3	1	25
1929	13	8	0	21
1930	14	2	1	23
1931	11	1	0	14
1932	4	1	0	6
1933	5	3	0	9

*Includes fatalities from all causes.
†39 killed in gas explosion.

Table II—Non-Fatal Accidents in Wyoming

Year	Falls	Haulage	Explosives	Eyes	Total*
1924	261	165	7	34	463
1925	189	140	5	19	543
1926	157	114	2	31	490
1927	136	105	7	9	410
1928	191	132	5	42	592
1929	158	104	4	37	531
1930	126	114	1	49	502
1931	104	73	0	15	344
1932	75	44	0	9	203
1933	68	41	0	14	226

*Includes accidents from all causes.

Table III—Roof and Coal Falls*

Year	Fatalities	Tons per Accident
1927	9	330,996
1928	6	448,532
1929	7	346,533
1930	2	914,629
1931	2	569,591
1932	0	708,993†

*Record of single company practicing systematic timbering.
†Total output.

State mine inspection in Colorado is supported by a tax of four mills per ton on the coal production of the State. This system of raising revenue not only cripples the work of the inspectors in a year of declining tonnage but also, as James Dalrymple, chief inspector, pointed out, unfairly apportions the burdens between large and small producers. Attempts to augment this income by the imposition of a graduated flat tax on every mine, ranging from $25 per year for operations employing three men to $40 per year for mines employing four or more men and producing over 15,000 tons per annum, were defeated in the State Legislature.

In 1913, when the present mining law went into effect, said Mr. Dalrymple, coal was being mined in 17 counties of the State and 142 out of a total of 178 mines were Class A operations (i.e., employing more than ten men). In 1931, coal was being mined in 25 counties, the number of mines had increased to 246, but the number of Class A mines had dropped to 102. In the year last mentioned, Mr. Dalrymple's department made 1,044 inspections, or an average of 3 per mine. There were 306 inspections of Class A mines, which paid 96 per cent of the tonnage tax. The average cost per inspection, including the investigation of fatal accidents, attending inquests and prosecutions, was $32.03. Class A mines, therefore, paid $104.90 per inspection, while the smaller mines contributed only $1.81.

Using the death and accident rates of 1908-12, with non-fatal accidents based on the 1913-31 ratio of such accidents to fatal accidents, because earlier data on non-fatal injuries were incomplete, Mr. Dalrymple estimated that the department had saved 926 lives since 1913 and had prevented 19,829 non-fatal accidents. Figuring the money cost at $4,000 per fatality and an average of $200 for each non-fatal accident, these accident reductions totaled $7,669,800. Such a record, he submitted, justified financial support which would permit adequate inspection. Each mine, he contended, should be inspected at least three times per year in order to maintain proper contacts with the industry and to follow through on the correction of dangerous conditions revealed in earlier inspections.

As told in the preceding issue (p. 114), the meeting expressed approval of his position on the necessity for frequent inspections and went on record "as favoring, through general taxation, the allotment of sufficient funds" to make such inspections and to perform such other work "as is required by law." Warned that the funds available in other States through general taxation were threatened by budget squeezing, the meeting directed that copies of the resolution adopted be sent to the governors of New Mexico, Utah and Wyoming as well as to the chief executive of Colorado.

That the work of the U. S. Bureau of Mines also was jeopardized by curtailment in appropriations was made clear by E. H. Denny, district engineer, in an address outlining the technologic, economic, administrative, and health and safety activities of this federal agency. Funds for the year ending June 30, 1934, had been cut to $1,100,000, as compared with a yearly average of $2,830,000 from 1928 to 1932. As a result, personnel had been reduced one-third, five field stations had been discontinued, the health division had been abandoned, research work in explosives had been curtailed and studies of falls and of underground mechanical equipment had been discontinued. First-aid and statistical work also had suffered.

Although the coal-mining industry has made great strides in accident reduction in the past four years, "the job is by no means completed." Despite the fact that there was only one major explosion disaster in 1933, there are still

Table IV—Accident Record—United States Fuel Co.

Year	Accidents: Falls	Haulage and Mach'ry	Miscellaneous	Total	Man-Hrs. Worked	Days Lost	Tons Mined	Accident Rates: Frequency	Severity	Tonnage	Fatalities
1928	43	26	42	111	718,272	22,289	887,771	154.7	31.0	24.0	3
1929	42	32	70	144	755,904	47,163	932,936	190.5	62.4	50.5	7
1930	21	10	34	65	590,472	20,048	710,960	110.0	33.9	28.3	3
1931	8	5	13	26	688,459	3,646	546,213	37.7	5.3	1.6	0
1932	12	5	6	23	573,503	12,514	430,257	38.4	21.8	29.1	2
1933	14	1	7	22	525,657	6,566	408,020	41.8	12.5	16.1	1

Rates are figured on the following bases: Frequency—accidents per million man-hours worked; Severity—days lost per thousand man-hours worked; Tonnage—days lost per thousand tons mined.

Fatal accidents are figured at 6,000 lost days. Permanent partial disability ratings follow tables of ratings for National Safety Competition. Temporary disability accidents rate the number of days actually off work and unable to work.

too many mines, declared Mr. Denny, "in which measures to prevent and minimize explosions are decidedly limited." Mining still has the unenviable distinction of having the highest accident-severity rate in the major industries. On the encouraging side of the picture is the fact that many mines have produced large tonnages or worked long periods without fatal accidents and even without lost-time accidents.

The reactions of the members of the Rocky Mountain Coal Mining Institute to the present precarious situation of the U. S. Bureau of Mines was voiced in a resolution calling upon Congress to appropriate sufficient funds to permit the Bureau adequately to carry on its work for safety and efficiency in mining. Preservation of the Bureau as the representative of the industry in any consolidations or reorganizations of federal departments also was demanded. Copies of the resolution were to be sent to Secretary Ickes, the American Mining Congress, union officials, code authorities and Congressmen from the Rocky Mountain States.

Mr. Russell's paper on safety progress at the United States Fuel Co., which was read by title only, outlined the accident-reduction campaign started by his company early in 1930. The statistical picture of results before and since this campaign was inaugurated is shown in Table IV. All men are trained in first-aid work and selected workers in mine-rescue and accident-prevention work. Key men or foremen are paid a slight monthly bonus for accident-free records. Accident data are charted monthly for each mine and outside department.

Protective hats are supplied to all underground men without charge. "We enforce the use of hard-toed shoes," said Mr. Russell's paper, "and we know that this is justified by the reduction in all accident rates." First-aid materials are kept at convenient places in all operating sections. These materials are in boxes with aluminum or ribbon seals which can be easily broken in case of accident. Each first-aid station has a small iron can which contains an electric-strip heater element in one compartment and several small canvas sacks of sand which are always kept warm and ready for emergency use to alleviate shock and keep accident patients warm.

Frequent hand, arm and body injuries to face drillers who could not be broken of the habit of grasping the threaded feed bar to pull the drill out before it ceased revolving were finally eliminated, said Mr. Russell, by fitting spool-shaped sleeves over the thread bar just back of the drill chuck. The sleeve remains stationary when grasped by the operator and "allows the drill and thread bar to continue revolving without danger to hands, gloves and clothing."

With mines 150 miles from the nearest general hospital and train service infrequent, transporting injured men for emergency operations or convalescence was a real problem to the coal company. The problem was solved by splitting the rear seat cushions of a standard Ford V-8 two-door sedan and removing one of the front seats to allow space for an aluminum ambulance cot. When not employed as an ambulance, the front seat is restored, the back cushions are put back and the sedan resumes its normal place for the use of company officials.

10-Year Safety Campaign Justifies Efforts

(Concluded from page 124)

dismissal. Supervision cannot in fairness to itself accept the workman's responsibility. Therefore, the workman is expected to do his part without special instructions when it is known he knows the rules. To illustrate: When a prop is required, the workman must place the prop promptly and not wait to be told to do so. Doubtless many accidents are thereby prevented.

The achievement over the past ten years has been made possible by a spirit of cooperation among the members of the general safety committee, between the officials and the workmen and among the workmen themselves. There have been many encouraging phases and some discouraging ones; among the latter, thoughtlessness and deceitfulness are perhaps outstanding. Occasionally an individual will attempt to hide the facts surrounding an injury. In a large measure, however, the workmen realize safety is very much in their interest, and their cooperation is readily given.

The goal for which we are striving is the elimination of all injuries. Some idea of our hopes may be gleaned from the fact that out of 65 lost-time accidents in the past five years, only one conscientiously could be classified as unavoidable.

Tipple Modernization At Island Creek

(Concluded from page 122)

equipped with frosted daylight blue glass were installed 30 in. above the tables and spaced on 24-in. centers. So, including lighting, Mine No. 1 is again equipped with a preparation plant that is thoroughly modern.

A compact Bean coal-treating unit, consisting of a wood tank, fitted with a power-driven stirring paddle, triplex pump, silent chain drive, 10-hp. General Electric motor and G. E. automatic pressure switch, was installed last autumn to replace earlier equipment. The switch automatically starts and stops the motor to maintain the coal-treating fluid at 300 lb. pressure in the feed line. The unit is illustrated on the Contents page of this issue.

Motor Equipment at Island Creek No. 1 Tipple

(Not Including Small Motors in Five Boom Hoists and in Gate Throwers)

Original Equipment:	Make	Horse-power	Synchronous Speed	Type
Main-slope conveyor	General Electric	100	600	Slip-ring
Main shaker	General Electric	60	600	Slip-ring
Picking tables	General Electric	25	720	Slip-ring
New Equipment:				
Lower crusher	General Electric	75	900	FTR
Upper crusher	General Electric	60	1200	Slip-ring
Crushed-coal shakers	General Electric	25	720	Slip-ring
Flight conveyor	General Electric	60	600	Slip-ring
42-in. belt conveyor	Westinghouse	10	1200	Squirrel-cage
Jouncer screen	General Electric	15	1200	Slip-ring
Jouncer screen	General Electric	15	1200	Slip-ring
36-in. belt conveyor	General Electric	20	1200	FTR
Vibrating screen	General Electric	3	1200	Squirrel-cage
Table-product flight conveyor	General Electric	5	1200	FTR
Table-product flight conveyor	General Electric	5	1200	FTR
Extension conveyor and boom	General Electric	5	1200	FTR
Extension conveyor and boom	General Electric	5	1200	FTR

ECONOMIC PROBLEMS

+ Share Honors With Operating Topics

At Rocky Mountain Meeting

PROBLEMS of code administration and merchandising shared honors with the more technical discussions of operating questions and safety work at the 32d regular meeting of the Rocky Mountain Coal Mining Institute, held at Denver, Colo., Feb. 26-28. The stage for this innovation was set in the opening address of L. R. Weber, retiring president, when he suggested that the organization broaden its scope to consider sales problems. He urged close cooperation with all other bodies having similar objectives and appealed particularly for intimate contact with manufacturers developing stokers and pulverized-coal burners.

Mr. Weber gave credit to NIRA and the bituminous code for an improved foundation for the industry. Despite reduced tonnages, he believed that the operators were in a better financial position. They must, however, be on the alert to take advantage of the new opportunities presented. He predicted more changes in preparation plants in the next two years than in the past decade, because of the increasing demand for slack. "There are few producers," he declared, "who are not using obsolete equipment which must be quickly replaced as soon as operations are on a profitable basis."

Continuing this theme at the closing day's sessions, J. J. Craron, sales agent, Independent Coal & Coke Co., warned his audience that the coal industry must present a united front against the inroads of competitive fuels and must put its house in order to overcome public antagonism. Illustrative of competitive inroads, he pointed out that one of the largest hotels in Spokane, Wash., is heated with sawdust and said that wood and duty-free Canadian coal are capturing the Northwest. In California, coal is retreating before gas, oil, wood, oil briquets and Chinese anthracite. Last year San Jose canneries gave away 5,000 tons of apricot pits, which replaced 1,000 tons of coal.

He indorsed Mr. Weber's view that demand for fine sizes would grow. Special sizes may mean additional screen sizes and degradation must be reduced. Buyers of the larger sizes will be increasingly critical of quality and preparation. In view of the fact that practically all coal used on the Pacific Coast is now delivered in sacks, loading in containers at the mines is more than a visionary idea. Operating departments must be alive to changing market conditions and be prepared to cooperate fully with the sales departments in meeting these changes.

H. H. Bubb
President, Rocky Mountain Coal Mining Institute

There are no set specifications for railway fuel, explained M. A. Sharp, fuel inspector, Union Pacific Railroad, in a paper read by Raymond R. Knill, ventilation engineer, Union Pacific Coal Co. But there are certain requirements with respect to cleanliness, slack content and thorough mixture of fine and large coal which must be considered. Because of space limitations, locomotives must burn more coal per square foot of grate area per hour than is required in ordinary stationary practice. Except where local anti-smoke ordinances prevail, this means that high-volatile coals are favored, because their gaseous content is readily evolved and about one-third of their total heat is liberated within two minutes after firing, while the remaining coke maintains a constant temperature and practically uniform rate of combustion.

High-moisture coals are objectionable because of the heat losses in evaporation. Surface moisture is particularly objectionable in cold climates because freezing makes it difficult to handle coal at the chutes. High-ash coals are frowned upon because the ash interferes with draft and because many modern locomotives have only limited facilities for cleaning fires en route. Miners, he said, must be taught that hobo wood pieces in coal are just as dangerous in stoker firing as tramp iron.

While a certain percentage of fines is desirable, minus $\frac{1}{4}$-in. material should be screened out. Mixtures must be thorough to reduce segregation of sizes in rehandling. The fact that many railroads crush mine-run before using does not mean that the fineness of the coal on leaving the mines is immaterial, because each handling increases degradation. If the slack content is excessive when leaving the mine, by the time it has been rehandled and crushed it will be much too fine for a satisfactory locomotive fuel.

NIRA, declared H. C. Marchant, secretary of the institute and chairman of the Division V Code Authority, is more than a Magna Charta for trade and industrial associations; "it is a challenge both to industry and to public service." Associations are the backbone of code government, "but the background of trade organization is as yet inadequate.

Code government and the opportunity it affords for deliberate industrial self-regulation have conferred privileges and imposed duties to which the association establishment of American industry has not yet adjusted itself."

The problems of trade associations and their code authorities are just beginning. Broadly speaking, code administration involves: (1) Deliberate and orderly planning, relying upon education and the desire of the majority to deal fairly with each other, with their employees and with the public; and (2) compliance, including complaints involving labor relations, trade practices, jurisdictional and competitive disputes. The greatest opportunity lies in the field of planning.

"NIRA affords the greatest potential chance in our history for a combination of sound industrial programs and right persons and right attitudes to make them work." If the program fails, "it will be because direct government regulation, which ultimately is necessarily political, will have supplanted industrial self-regulation. NIRA gives industry not only the opportunity for self-regulation but, what is more important, the enforceable means of making it effective."

Discussing the statistical aspects of code administration, John R. Doolin, secretary, Division V, asserted that one aim of the statistical activities was to educate certain Senators with an anti-price-fixing complex on the true facts of the industry. The A, B, C, D reports called for by NRA, for example, showed a spread in net realizations in Division V ranging from a loss of 90c. per ton to a profit of 90c. per ton. The period covered by the reports was the one of greatest normal activity in the Rocky Mountain area; compilation of the data should be continued until at least a full year's records were available. "It may be expensive to compile these reports," he warned, "but it will be more costly to the industry to discontinue their compilation before the record is complete."

In addition to the papers on safety and mechanical loading, treated elsewhere in this issue (see pp. 123, 132 and 125), the meeting also considered a number of other operating problems. A "talkie" by Edwin C. Hill on preformed wire rope was presented on the first day, and Fred Carstarphen, consulting engineer, showed a "movie" on aerial tramways adapted to mining on the second day. Walter Bachman, Card Iron Works Co., emphasized the importance of metallurgy and manufacturing skill in successful wheel production; cast-iron and semi-steel wheels, he stated, still led the field in the mining industry.

Open gearing, said Charles M. Schloss, Lindrooth, Shubart & Co., in a series of random notes which he characterized as combining the features of the Operating Ideas and New Equipment sections of *Coal Age*, are fast yielding to the longer-lived, more economical reducer drives running in substantial oil-and-dust-tight cases. The newest development in this line is the gearmotor, which frequently costs no more than a separate motor and gear assembly. Multispeed squirrel-cage motors are replacing slip-ring motors for variable-speed work.

Manufacturers' capacity ratings on crushers, he continued, are on a mine-run basis. When prepared sizes are handled, these rating must be materially reduced. When a crusher is set to produce any particular ring-size product, 10 to 20 per cent will be oversize because of the spring relief. The crusher should be in a closed circuit with a screen and the oversize should be returned to the crusher for further treatment. Hammer and ring mills, although pulverizing much coal, can deliver direct to the cars without additional screening.

"Spring bumpers and draft gear have been adopted as standard by one Utah company on cars weighing about 4,500 lb. and holding 3½ to 4 tons mechanically loaded and 5 tons when hand loaded. This is considerable advantage in starting trips in avoiding the quick jerks encountered with solid couplings. Yellow paint makes a car more easily seen in the dim light underground—just as a yellow street car is easily seen on a dark, cloudy day."

How the Owl Creek Coal Co. licked the scale problem by treating its water with a lime-and-soda softener and sodium aluminum coagulant was told by Val Cassidy, electrical engineer. Before this system was adopted, "scale was being drilled out, boilers washed, and tubes replaced continually" and surface condensers were encrusted with spray-pond scale. "The result was high fuel consumption, high maintenance costs and insufficient power supply to operate the mines at top capacity."

The softener was placed in operation in the spray ponds and, one at a time, these ponds were drained, washed and filled with soft water. A pressure sand filter was placed in the line between the softener and the ponds to filter out all sediment not precipitated in the softener. The coagulant aided the softening process, greatly improved precipitation and left any sediment passing out with the softened water in a light, fluffy state and readily removable by the sand filter. Condensers now run 8 to 10 months without opening and then show only a small amount of soft, slimy sediment in the bottom of each tube. This can be flushed out easily with a garden hose. With this system it has been possible to keep the water in the ponds between 0 and 1 grain of hardness per gallon.

Although the lime-and-soda-process softener is ideal for treating boiler water, it could not be used at Owl Creek, explained Mr. Cassidy, because the softener capacity was insufficient to supply both ponds and boilers. So the boilers were used as a hot-process softener. A barrel, connected to the suction side of the feed pumps, was filled with water every 8 hours and a dosage of soda ash and soda aluminate dissolved in the water and then the mixture was fed into the boilers for 15 to 20 minutes. "This was found to give much less trouble than any continuous feeding arrangement and produced just as good results."

In this process, the heat in the boiler takes the place of lime in precipitating the bicarbonates. Water in the boilers can be kept at any degree of hardness. Blow-down control is important; if the concentration was allowed to rise above 20 to 30—depending on the hardness of the raw water—a carry-over sometimes would result. If too much blow-down was practiced fuel and chemicals were wasted. Boiler water was tested each morning and the results of the tests, together with the required dosage of chemicals, were posted on a blackboard in the boiler room. Each boiler was tested separately. Cost of treating the water for both ponds and boilers averaged $6 per day, or about two-thirds the cost of a single boiler tube.

The boiler plant, which has since been placed on the external softener, was operated on the hot-process treatment for two years. No drilling of scale was necessary; five of the eight boilers were washed once during the two years and the other three were not washed. Power requirements were met at a great saving in fuel and tube replacements were cut to a minimum.

More Than Codes

Tired of reading about codes? Fed up on merchandising talks?

Even so, when Mr. Sharp tells you hobo wood is as unpalatable as tramp iron, he points straight down the production man's alley. And Mr. Schloss has some interesting and meaty equipment notes, while Mr. Cassidy steps up with practical help on mine-power-plant problems from spray pond to boiler. All summarized in this story.

But that does not complete the Rocky Mountain catalog. Mechanical loading with shaking conveyors and scraper loaders in Wyoming and with track-mounted machines in Indiana is discussed on p. 125 of this issue. Mr. Davis gives the picture of a ten-year safety drive at Phelps Dodge mines on p. 123, and there is still another safety story from the Far West on p. 132.

PRE-CODE COMMITMENTS

+ Hit Sales Income During Test Period;

NRA Studies Cost of Shorter Work-Day

SELLING approximately 37.1 per cent of the production at code prices, operators of 1,274 shaft, slope and drift mines shipping bituminous coal to the commercial market in November, 1933, realized an average net profit, exclusive of interest charges and federal income taxes, of 2.077c. per ton. This net gain was made, according to figures compiled by NRA from the *A-B-C-D* reports sent out last winter, despite losses in Divisions I, III and IV because of the profits reported by operators in Divisions II and V, who shipped less than 23.6 per cent of the output during the month. The total net production covered by the NRA reports was 19,697,847 tons—approximately 80 per cent of the commercial output for the month.

Division I, with 903 mines reporting, had a net production of 14,408,850 tons, sold 36.9 per cent of the tonnage at code prices and lost 0.5c. per ton. Division II, 164 mines reporting, had a production of 3,507,996 tons, sold 33.0 per cent at code prices and made 9.8c per ton. Division III, with 49 mines reporting a net production of 471,118 tons, sold 25.6 per cent at code prices and lost 16.5c. per ton. Division IV, with 47 mines reporting 177,148 tons, sold 49.8 per cent at code prices, but lost 8.4c. per ton. The Rocky Mountain group (Division V), with 111 mines reporting, sold 56.1 per cent of its 1,132,735 tons at code prices and made 20.3c. per ton.

These figures differ somewhat from corresponding data based on the *A* report summaries of costs and realizations which are the basis for the information shown in Tables II, III, IV and V. This difference is due to the fact that the number of individual mine-cost reports (Form A) which was rejected by the NRA statistical unit because of errors was greater than in the case of the *D* reports. On the basis of the *A* reports covering 1,167 deep mines with a tonnage of 19,590,704 in November, 800 operations in Division I, with an output (including net changes due to inventory adjustments) of 14,303,798 tons, sold 35.3 per cent of the production at code prices and lost $63,923.52, or 0.45c. per ton.

For Division II, with 151 mines reporting, the tonnage was 3,411,179; the output sold at code prices, 25.8 per cent, and the net profit, $323,786.71, or 9.49c. per ton. Division III, with 51 mines reporting, had an output of 485,832 tons, sold 20.9 per cent at code prices and lost $83,148.00, or 17.12c. per ton. Division IV, with 51 mines reporting, had an output of 184,619 tons, sold 43.4 per cent at code prices and lost $15,213.01 or 8.24c. per ton. In Division V, 114 mines reported an output of 1,205,276 tons, sold 44.1 per cent at code prices and made $312,441.39, or 25.92c. per ton. On the basis of the *A* figures, the total net profit for these 1,177 mines was $473,943.57, or 2.419c. per ton.

Although, as is shown in Tables II to V inclusive, in some cases the margin of safety between November costs and code-price realizations is dangerously thin, in only a few fields were code prices below costs. The most pronounced case of this character was the Arkansas anthracite area, where code prices fell 28.52c. below costs; the tonnage involved, however, was only slightly in excess of 16,000. The Barnesboro district in central Pennsylvania had a cost of $1.9779 and a code average of $1.7541. Broad Top and South Fork code averages were slightly under the cost line and the same thing was true of the Peoria district in Illinois. Lucas and Warren counties, Iowa, had a cost nearly 20c. per ton higher than their code-price average.

The favorable showings made in Divisions II and V, moreover, are subject to qualification in that November comes into the period of normal peak demand in the Rocky Mountain States, and to a slightly lesser extent in Division II (Illinois-Indiana-Iowa). With domestic consumption tapering off as the winter closes, many mines in these areas cannot expect to maintain the same rate of operations they enjoyed in November. As the number of days the

TABLE I—AVERAGE DAILY EARNINGS UNDER THE CODE

(Nov. 1 to 15, 1933)

Division and Wage District and Base Rate†	All Employees* Starts	All Employees* Earnings	Inside Day Men Starts	Inside Day Men Earnings	Outside Day Men Starts	Outside Day Men Earnings	Piece-Workers‡ Starts	Piece-Workers‡ Earnings
Division I								
District A ($4.60)	8.4	$4.49	9.3	$4.65	9.3	$4.01	8.1	$4.53
District B ($4.36)	8.0	4.46	8.6	4.41	8.9	3.85	7.7	4.59
District C ($4.20)	8.0	4.29	8.6	4.19	8.7	3.65	7.5	4.52
District H ($4.00)	7.5	3.68	8.0	3.94	8.2	3.11	7.1	3.71
Division II								
District E ($5.00)	7.6	5.13	7.9	5.12	8.9	4.16	7.4	5.13
District D ($4.57½)	8.2	5.10	8.8	4.85	9.5	4.37	7.9	4.96
District F ($4.70)	7.8	4.93	9.0	4.62	9.7	4.18	7.2	5.14
District F ($4.56)	5.1	4.57	5.4	4.59	5.6	4.34	5.0	4.59
Division III								
District J ($3.40)								
Alabama	7.1	3.22	8.0	3.16	7.9	2.85	6.5	3.38
Tennessee-Georgia	6.6	4.08	7.1	3.58	8.0	3.39	6.5	4.06
Division IV								
District G ($3.75)								
Southwest	7.5	3.79	8.2	3.85	9.2	3.36	7.1	3.82
Ark.-East Okla	4.9	3.80	5.2	4.09	6.3	3.31	4.5	3.78
Ark. anthracite	5.1	4.14	4.4	4.04	6.3	3.10	4.9	4.49
Division V								
District K § ($4.48)	9.9	4.20	10.8	4.79	11.3	3.78	9.1	4.19
District M ($5.44)	9.2	5.80	10.0	5.56	9.9	4.91	8.5	6.33
District P ($5.40)	9.9	5.72	10.9	5.14	10.7	4.46	8.5	6.80

† For description of fields covered by each wage district, see *Coal Age*, Vol. 38, p. 353; base rates shown are the code minima for skilled inside labor.

* Exclusive of clerical and supervisory employees.
‡ Mining, cutting and loading.
§ Central New Mexico only.

TABLE II—PRODUCTION COSTS, SALES AND ADMINISTRATIVE EXPENSES

		Pennsylvania		West Virginia				
PRODUCTION COSTS Mine Labor	Division	Western	Central	Maryland	Upper Potomac[1]	Northern	Panhandle	Ohio
Day men[2]	$0.3072	$0.3209	$0.2711	$0.4154	$0.3844	$0.2519	$0.2493	$0.2708
Mining (piece and day)	.5134	.5682	.6221	.6080	.5881	.4596	.6009	.5964
Yardage and deadwork	.0492	.0464	.0939	.0651	.1042	.0141	.0763	.0423
Supervisory and clerical	.0646	.0486	.0727	.0629	.0545	.0486	.0433	.0561
Total Mine Labor	.9344	.9841	1.0598	1.1514	1.1352	.7742	.9698	.9656
Mine Supplies								
Total (ex. power and fuel)	.1487	.1450	.1646	.1638	.1618	.1142	.1554	.1477
Purchased power	.0637	.0591	.0807	.0549	.0599	.0463	.0504	.0647
Mine fuel[3]	.0067	.0054	.0147	.0102	.0068	.0057	.0056	.0027
Total Mine Supplies	.2191	.2095	.2600	.2289	.2285	.1622	.2114	.2151
Other Mine Expenses[4]								
Salaries and Expenses	.0216	.0250	.0282	.0374	.0186	.0217	.0025	.0111
Mine office expenses	.0059	.0034	.0069	.0092	.0085	.0032	.0007	.0119
Fixed Lump-Sum Charges								
Taxes[5]	.0228	.0305	.0247	.0317	.0510	.0131	.0103	.0087
Insurance (ex. compensation)	.0074	.0039	.0056	.0081	.0099	.0050	.0064	.0055
Company houses[6]	*.0078*	*.0082*	*.0078*	*.0043*	.0031	*.0102*	*.0092*	*.0085*
Depreciation[7]	.0880	.0875	.0970	.0743	.0615	.0608	.0808	.0465
Per-Ton Basis Charges								
Royalties paid or accrued	.0535	.0280	.0488	.0189	.0373	.0360	.0308	.0396
Association expenses	.0038	.0017	.0019	.0126	.0027	.0022	.....	.0038
Compensation insurance	.0448	.0488	.0401	.0348	.0600	.0345	.0593	.0866
Code authority expense	.0063	.0061	.0100	.0087	.0125	.0032	.0048	.0077
Depletion[7]	.0414	.0994	.0291	.0512	.0038	.0419	.0328	.0344
Total Production Cost	1.4412	1.5197	1.6043	1.6629	1.6326	1.1478	1.4004	1.4280
TOTAL SALES EXPENSE	.0931	.0457	.0831	.1046	.0649	.0876	.0637	.0939
TOTAL ADMINISTRATIVE EXPENSE	.0511	.0471	.0632	.0713	.0742	.0508	.0324	.0318
Total Cost per Ton	1.5854	1.6125	1.7506	1.8388	1.7717	1.2862	1.4965	1.5537
INCOME FROM COAL SALES								
Pre-code price sales	1.3997	1.4573	1.6059	1.6417	1.6409	1.1885	1.4650	1.4743
Orders under code prices	1.8454	1.8578	1.8976	1.8740	2.0430	1.5008	1.5827	1.8134
Shipments to storage[8]	1.5582	1.7998	2.0934	2.2889	1.8750	.....	.....	1.4750
Coal to beehive ovens and briquet plants	1.6174	1.9105	1.8927	.....	2.2346	1.3045	.5000	1.5354
Mine sales to dealers and retail customers[9]	2.0825	2.0350	2.2337	2.1599	2.0215	1.6429	2.4869	2.3869
Used for mine heat and/or power	1.5078	1.5692	1.5765	1.6153	1.9138	1.3360	1.7198	1.3725
Total Income From Coal Sales	1.5809	1.6298	1.6904	1.7321	1.7979	1.2965	1.5513	1.6508

[1]Grant, Mineral and Tucker counties. [2]Paid by hour, day or month. [3]At previous month's cost. [4]Not otherwise allocated. [5]On mine property and equipment and other taxes in lieu thereof, except on unassigned acreage. [6]Includes fixed charges, less income; where income exceeds charges, the item is shown in italic figures. [7]On income-tax basis of calculation. [8]Includes shipments to rail yards and docks (see Sec. 6, Art. 6 of Bituminous Coal Code). [9]Includes house coal.

mines run decline, costs per ton will increase. This influence of the rate of operation on costs is plotted in the curves in Fig. 1.

The NRA studies summarized in this article were undertaken in accordance with the provisions of Sec. (g) of Art. V of the Code of Fair Competition for the Bituminous Coal Industry, which reads as follows:

As soon as possible after the adoption of this Code, the National Recovery Administration shall undertake, through a designated committee or agency, an investigation for the purpose of reporting on or before Dec. 31, 1933; upon (*a*) the practicability and cost (assuming the maintenance of existing rates of pay) of applying a shorter work-day and work-week, (*b*) the effect and advisability of revising wage differentials in the various divisions and districts of the industry and in the event of recommended change specification of the amount thereof; (*c*) the sales obtained for coal, or reasonably to be anticipated, up to the time of the report, for the purpose of determining whether wages and employment can be further increased or maintained without imposing undue burdens upon the industry.

In the *A-B-C-D* reports, the statistical unit of the coal section, under F. E. Berquist, seeks to answer questions as to existing costs and realization and the earnings of different classes of mine labor. Inquiry into the cost of the shorter work-day and work-week was assigned to a special committee of engineers. In-

TABLE III—PRODUCTION COSTS, SALES AND ADMINISTRATIVE EXPENSES AND SALES INCOME PER NET TON, NOVEMBER, 1933—DIVISION II

		Illinois					Indiana				
PRODUCTION COSTS Mine Labor	Total Illinois	Northern	Central[1]	Belleville	Southern	Total Indiana	Brazil-Clinton	Linton-Sullivan	Ayrshire-Princeton	Iowa
Day men[2]	$0.3639	$0.4465	$0.3725	$0.3485	$0.3562	$0.3145	$0.3196	$0.3146	$0.3057	$0.4015
Mining (piece and day)	.4147	.8680	.4044	.4587	.3939	.3860	.4470	.4213	.2104	.8116
Yardage and deadwork	.0225	.0811	.0274	.0180	.0162	.0150	.0206	.0161	.0032	.2163
Supervisory and clerical	.0529	.0992	.0393	.0546	.0647	.0710	.0716	.0755	.0607	.0867
Total Mine Labor	.8540	1.4948	.8436	.8798	.8310	.7865	.8588	.8275	.5800	1.5161
Mine Supplies										
Total (ex. power and fuel)	.1962	.1475	.2174	.1535	.1887	.2207	.1885	.2142	.2892	.1491
Purchased power	.0451	.0514	.0529	.0229	.0431	.0441	.0460	.0437	.0418	.0777
Mine fuel[3]	.0193	.0483	.0122	.0342	.0211	.0188	.0187	.0230	.0102	.0136
Total Mine Supplies	.2606	.2472	.2825	.2106	.2529	.2836	.2532	.2809	.3412	.2404
Other Mine Expenses[4]										
Salaries and expenses	.0131	.0152	.0156	.0033	.0134	.0068	.0098	.0047	.0059	.0201
Mine-office expenses	.0041	.0083	.0037	.0006	.0053	.0040	.0031	.0022	.0094	.0012
Fixed Lump-Sum Charges										
Taxes[5]	.0103	.0219	.0066	.0106	.0136	.0053	.0054	.0041	.0072	.0070
Insurance (ex. compensation)	.0036	.0191	.0030	.0025	.0038	.0039	.0054	.0035	.0020	.0060
Company houses[6]	*.0005*	.....	.0004	*.0016*	*.0012*	*.0002*	.....	*.0004*	.0001	*.0045*
Depreciation[7]	.0779	.0570	.0838	.0506	.0807	.0698	.0757	.0628	.0737	.0996
Per-Ton Basis Charges										
Royalties paid or accrued	.0202	.0077	.0185	.0141	.0243	.0323	.0360	.0406	.0093	.0751
Association expenses	.0060	.0025	.0038	.0034	.0093	.0054	.0063	.0054	.0036	.0093
Compensation insurance	.0536	.1108	.0495	.0473	.0574	.0593	.0656	.0636	.0399	.0687
Code authority expense	.0013	.0081	.0006	.0014	.0017	.0026	.0026	.0024	.0031	.0171
Depletion[7]	.0224	.0693	.0175	.0144	.0277	.0344	.0163	.0425	.0496	.0279
Total Production Cost	1.3266	2.0619	1.3291	1.2370	1.3199	1.2937	1.3382	1.3398	1.1250	2.0840
TOTAL SALES EXPENSE	.0799	.1108	.0752	.0512	.0920	.0892	.1058	.0797	.0794	.0758
TOTAL ADMINISTRATIVE EXPENSE	.0501	.0766	.0550	.0352	.0483	.0427	.0377	.0481	.0403	.0844
Total Cost per Ton	1.4566	2.2493	1.4593	1.3234	1.4602	1.4256	1.4817	1.4676	1.2447	2.2442
INCOME FROM COAL SALES										
Pre-code price sales	1.4054	2.3566	1.4512	1.1701	1.3866	1.3775	1.5073	1.2954	1.1916	2.0172
Orders under code prices	1.7687	2.6648	1.7244	1.3246	1.9514	1.6874	1.6343	1.7824	1.5638	2.5957
Shipments to storage[8]	1.3822	1.6494	.....	1.3691	.....	.....	.....	.....	.....	.....
Coal to beehive ovens and briquet plants	2.2482	.....	2.3871	.....	*.3302*	.7299	.....	.7299	.....	.....
Mine sales to dealers and retail customers[9]	2.2187	3.1526	2.2849	1.7769	2.0645	2.1846	2.3073	2.0483	2.1352	2.7207
Used for mine power and/or heat	1.2912	2.2698	1.2723	1.1074	1.1465	1.0337	1.1184	.9893	.9836	1.6473
Total Income From Coal Sales	1.5554	2.5812	1.5800	1.3049	1.5607	1.5032	1.5614	1.4929	1.4232	2.3635

[1]Includes Peoria district. [2] to [9]. See footnotes, Table II.

AND SALES INCOME PER NET TON, NOVEMBER, 1933—DIVISION I

Total High-Volatile	Big Sandy-Elkhorn	Harlan	Hazard	Kanawha	Logan	Southern High-Volatile Fields: Williamson	Southern Appalachian	Virginia	Total Low-Volatile	Southern Low-Volatile Fields: Pocahontas	Greenbrier	New River	Winding Gulf	Michigan	Western Kentucky
$0.3143	$0.3754	$0.2782	$0.3366	$0.2815	$0.2602	$0.3570	$0.3824	$0.3702	$0.3576	$0.3599	$0.2658	$0.3510	$0.3686	$0.3542	$0.2759
.4535	.5097	.4869	.4569	.4871	.3785	.3972	.5418	.4972	.4389	.3955	.4552	.5177	.4652	.9031	.3988
.0346	.0615	.0288	.0515	.0299	.0138	.0189	.0645	.0562	.0563	.0442	.0390	.1026	.0500	.2426	.0034
.0677	.0799	.0603	.0832	.0629	.0441	.0720	.0868	.0926	.0883	.0890	.0671	.0880	.0897	.0718	.0487
.8701	1.0265	.8542	.9282	.8614	.7016	.8451	1.0755	1.0162	.9411	.8886	.8271	1.0593	.9735	1.5717	.7268
.1433	.1285	.1493	.1615	.1334	.1421	.1674	.1590	.1316	.1654	.1644	.1644	.1759	.1606	.2236	.1314
.0617	.0393	.0707	.0774	.0583	.0572	.0748	.0745	.0760	.0700	.0667	.0690	.0914	.0619	.0725	.0519
.0053	.0153	.0018	.0027	.0043	.0002	.0013	.0134	.0112	.0062	.0079	.0006	.0041	.0050	.1003	.0067
.2103	.1831	.2218	.2416	.1960	.1995	.2435	.2469	.2188	.2416	.2390	.2340	.2714	.2275	.3964	.1900
.0199	.0339	.0029	.0136	.0134	.0259	.0253	.0114	.0120	.0227	.0165	.0097	.0332	.0289	.0268	.0069
.0072	.0069	.0030	.0056	.0157	.0058	.0065	.0044	.0025	.0060	.0078	.0024	.0058	.0032	.0003	.0036
.0187	.0217	.0112	.0124	.0216	.0200	.0187	.0114	.0209	.0291	.0317	.0198	.0318	.0234	.0078	.0253
.0085	.0093	.0102	.0103	.0094	.0059	.0107	.0095	.0063	.0129	.0160	.0070	.0083	.0108	.0090	.0077
.0075	*.0105*	*.0058*	*.0075*	*.0158*	*.0015*	.0027	*.0294*	*.0043*	*.0069*	.0004	*.0043*	*.0201*	*.0118*	.....	*.0058*
.0941	.0768	.1345	.0722	.0924	.0796	.1146	.0808	.1354	.1051	.1137	.1183	.1029	.0889	.1715	.0815
.0730	.0346	.0837	.0970	.0668	.0759	.0843	.0940	.0875	.0845	.0718	.1158	.0755	.1106	.0507	.0074
.0063	.0111	.0123	.0048	.0060	.0031	.0032	.0037	.0091	.0051	.0064	.0016	.0054	.0031	.0021	.0040
.0369	.0230	.0485	.0518	.0266	.0343	.0483	.0499	.0443	.0454	.0457	.0387	.0485	.0436	.0502	.0198
.0076	.0115	.0058	.0090	.0065	.0058	.0083	.0085	.0079	.0036	.0032	.0032	.0058	.0027	.0095	.0010
.0208	.0475	.0295	.0038	.0132	.0203	.0190	.0076	.0045	.0217	.0276	.0148	.0183	.0137	.1253	.0132
1.3659	1.4754	1.4118	1.4446	1.3132	1.1762	1.4302	1.5742	1.5611	1.5119	1.4684	1.3881	1.6461	1.5181	2.4213	1.0814
.1230	.1238	.1598	.1378	.1055	.1214	.1152	.1334	.1152	.1194	.1079	.0979	.1345	.1333	.0941	.0842
.0527	.0562	.0645	.0483	.0517	.0510	.0377	.0641	.0578	.0479	.0537	.0365	.0665	.0259	.1743	.0608
1.5416	1.6554	1.6361	1.6309	1.4704	1.3486	1.5831	1.7717	1.7341	1.6792	1.6300	1.5225	1.8471	1.6773	2.6897	1.2264
1.3336	1.3318	1.3918	1.3309	1.3949	1.2770	1.3265	1.3724	1.3458	1.3002	1.1930	1.6214	1.4228	1.3549	2.6994	1.0276
1.8047	1.7912	1.8683	1.8375	1.7002	1.6927	1.7376	1.9338	2.1324	2.1038	1.9843	1.8254	2.2408	2.2767	3.1821	1.3915
1.7160	.....	.....	1.8031	1.7402	1.0179	1.5143	.....	1.5502	1.4878	1.4878	.....	.....	.....	.....	.....
1.4266	.....	.....	.....	1.3921	.....	1.5821	.....	1.4688	1.4877	1.4160	2.0000	1.5884	1.4976	.....	.....
1.6671	1.7573	1.7105	1.6789	1.3727	1.7479	1.6791	1.7224	1.9552	1.7911	1.8514	2.1242	1.8696	1.5925	3.4888	1.7416
1.4302	1.2636	2.0636	1.8678	1.5021	2.8816	1.5250	1.3650	1.7600	1.4357	1.3740	1.3333	1.4045	1.5813	2.0951	.7331
1.5381	1.4899	1.6969	1.6610	1.5302	1.4337	1.5254	1.7323	1.5915	1.6456	1.5609	1.6953	1.8129	1.6858	2.9492	1.1569

directly, however, the statistical unit has contributed to the inquiry on the effect of a shortened work-week by analyzing the November costs. Using as a base line the actual cost per ton for the days operated in November, the statistical unit has estimated the cost per ton for operations of from 2 to 26 days per month. Fig. 1 is based upon these projections.

Studies of earnings are based upon payroll figures for the first half of November and cover average earnings for the various classes of labor and the frequency distribution of earnings within each class. The daily averages and the number of starts in the half month for the major classifications are summarized in Table I. The frequency distribution tables for Division I show that for all classes of labor (exclusive of supervisory and clerical forces) 32.9 per cent of the men in District A (Pennsylvania, Ohio, Michigan and the West Virginia Panhandle) earned less than $30 for the two weeks and 45.1 per cent received over $40. For northern West Virginia, 41.4 per cent fell in the minus $30 group and 40.2 per cent earned over $40. The Southern fields (District C) reported 39.4 per cent of the men receiving less than $30; and 34.9 per cent, $40 or more. Western Kentucky reported 64.8 per cent of the men earning less than $30 and only 15.7 per cent receiving $40 or more.

Except for Appanoose and Wayne counties, Iowa, Division II showed a high percentage in the upper brackets. In Illinois, only 27.8 per cent of the men earned less than $30, while 43.5 per cent received $40 or more. In Indiana, 28.4 per cent fell in the lower group and 53.2 per cent in the higher bracket. In Iowa, 62.3 per cent of the Wayne-Appanoose labor and 32.6 per cent of the men in the rest of the State earned less than $30; 17 per cent of the Wayne-Appanoose workers and 46 per cent in other parts of the State received $40 or more during the first half of November. Division III, with a base rate of $3.40 as a minimum for skilled inside labor, reported 76.4 per cent of the Alabama miners and 62 per cent of the Tennessee-Georgia workers receiving less than $30, with only 6.4 per cent in Alabama and 10.6 per cent in Tennessee-Georgia earning $40 or more.

The Southwest, with a $3.75 minimum, also reported most of the men receiving under $30. In the Arkansas-eastern Oklahoma subdivision, 83.3 per cent fell in this class; in the anthracite field, 74.1 per cent; in the Southwestern subdivision, 56.4 per cent. Only 7.6 per cent of the workers in the Arkansas-eastern Oklahoma subdivision received $40 or more; 11.7 per cent in the anthracite field were in this group and 16.8

TABLE IV—PRODUCTION COSTS, SALES AND ADMINISTRATIVE EXPENSES AND SALES INCOME PER NET TON, NOVEMBER, 1933—DIVISION III

	Alabama: Total	Alabama: Mary Lee	Alabama: Other Seams[1]	Tennessee
PRODUCTION COSTS				
Mine Labor				
Day men[2]	$0.4090	$0.3431	$0.4813	$0.3031
Mining (piece and day)	.5298	.5009	.5141	.6754
Yardage and dea twork	.0700	.0845	.0524	.1269
Supervisory and clerical	.1108	.0891	.1237	.1034
Total Mine Labor	1.1196	1.0176	1.1715	1.2088
Mine Supplies				
Total (ex. power and fuel)	.2236	.1884	.2555	.1566
Purchased power	.1193	.0991	.1380	.0601
Mine fuel[3]	.0115	.0010	.0252	.0092
Total Mine Supplies	.3544	.2885	.4187	.2259
Other Mine Expenses[4]				
Salaries and expenses	.0365	.0357	.0374	.0187
Mine-office expenses	.0048	.0024	.0079	.0055
Fixed Lump-Sum Charges				
Taxes[5]	.0372	.0328	.0416	.0221
Insurance (ex. compensation)	.0119	.0119	.0115	.0153
Company houses[6]	*.0157*	*.0185*	*.0158*	.0007
Depreciation[7]	.1440	.0931	.1880	.0779
Per-Ton Basis Charges				
Royalties paid or accrued	.0709	.0642	.0782	.0689
Association expenses	.0044	.0043	.0032	.0060
Compensation insurance	.0279	.0205	.0358	.0350
Code authority expense	.0032	.0024	.0036	.0037
Depletion[7]	.0275	.0437	.0125	.0522
Total Production Cost	1.8290[10]	1.5986	1.9996[11]	1.7407
TOTAL SALES EXPENSE	.0893	.0714	.0915	.0842
TOTAL ADMINISTRATIVE EXPENSE	.1249	.0856	.1576	.1200
Total Cost per Ton	2.0432	1.7556	2.2487	1.9449
INCOME FROM COAL SALES				
Pre-code price sales	1.6414	1.4930	1.7843	1.6925
Orders under code prices	2.5879	1.9201	2.6833	2.1590
Shipments to storage[8]	.....	.....	.....	.....
Coal to beehive ovens and briquet plants	1.6000	1.6000	.....	1.6994
Mine sales to dealers and retail customers[9]	2.5853	2.1340	2.8372	2.3688
Used for mine power and/or heat	2.0893	1.0508	2.1710	.7962
Total Income From Coal Sales	1.8730	1.5589	2.0795	1.7707

[1]Exclusive of Black Creek-West, with total labor cost of $1.3403, supply cost of $0.3726, total production cost of $2.1114, total cost of $2.4262, and average income from sales of $2.3602 per ton. [2] to [9]. See footnotes, Table II. [10]Includes $0.0024 for hauling. [11]Includes $0.0055 for hauling.

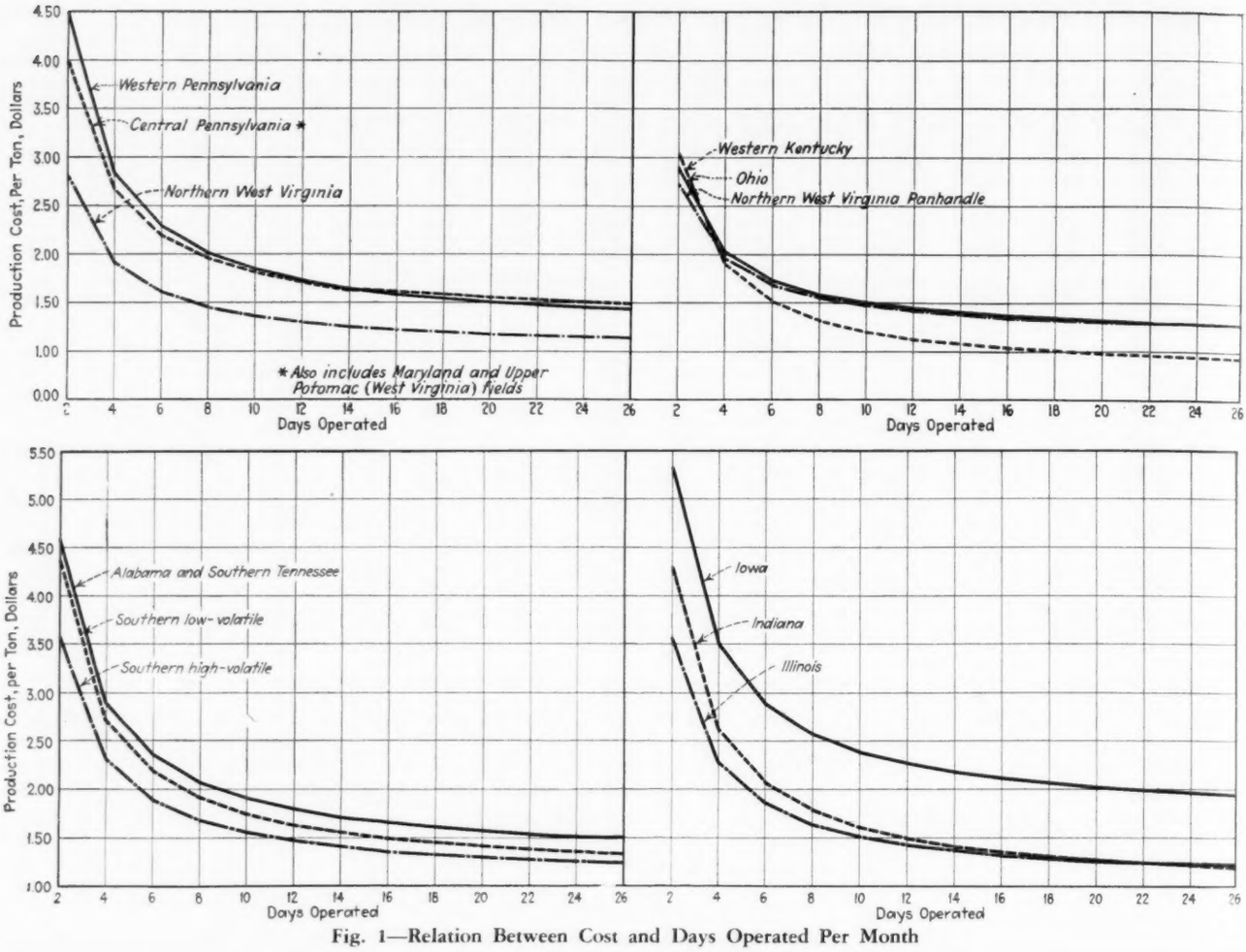


Fig. 1—Relation Between Cost and Days Operated Per Month

TABLE V—PRODUCTION COSTS, SALES AND ADMINISTRATIVE EXPENSES AND SALES INCOME, PER NET TON, NOVEMBER, 1933, DIVISIONS IV AND V

(INCLUDING STRIPPING MINES)

	Division IV				Division V					
						Colorado				
PRODUCTION COSTS	Arkansas and East Oklahoma[1]	Arkansas Anthracite	Southwest Sub-division[11]	Stripping Kansas-Missouri	Total[12]	Northern	Southern	Utah	Washington[12]	Stripping No. Dakota
Mine Labor										
Day men[2]	$0.6895	$0.7233	$0.3932	$0.3383	$0.4372	$0.3569	$0.4502	$0.4516	$0.4878	$0.3907
Mining (piece and day)	.6554	1.0845	.7521	.0122	.5610	.6147	.6144	.4829	.8544	.0099
Yardage and deadwork	.0818	.1046	.1585	.0196	.0491	.0841	.0788	.0137	.0459	.....
Supervisory and clerical	.2009	.2686	.0884	.0477	.1056	.0699	.1437	.0857	.1336	.0307
Total Mine Labor	1.6276	2.1810	1.3922	.4178	1.1529	1.1256	1.2871	1.0339	1.5217	.4313
Mine Supplies										
Total (ex. power and fuel)	.4050	.4963	.1554	.2414	.2142	.1806	.2120	.2232	.2108	.1206
Purchased power	.1556	.2099	.0682	.1235	.0901	.0573	.1051	.0945	.0795	.0764
Mine fuel[3]	.0334	.0335	.0208	.0043	.0250	.0351	.0348	.0015	.0089	.0060
Total Mine Supplies	.5940	.7397	.2444	.3692	.3293	.2730	.3519	.3192	.2992	.2030
Other Mine Expenses[4]										
Salaries and expenses	.0240	.....	.0270	.0085	.0123	.0114	.0244	.0017	.0103	.0189
Mine-office expenses	.0641	.0097	.0135	.0106	.0025	.0027	.0055	.0004	.0004	.0052
Fixed Lump-Sum Charges										
Taxes[5]	.0166	.0140	.0176	.0146	.0538	.0230	.0794	.0750	.0190	.0141
Insurance (ex. compensation)	.0170	.0264	.0061	.0068	.0106	.0075	.0142	.0112	.0049	.0071
Company houses[6]	.0088	.....	.....	.0044	*.0097*	*.0030*	*.0159*	*.0275*	*.0074*	*.0037*
Depreciation[7]	.1541	.0637	.0746	.1940	.1414	.0740	.1882	.1871	.1022	.1414
Per-Ton Basis Charges										
Royalties paid or accrued	.1349	.6777	.0746	.1035	.0655	.1154	.0673	.0395	.0552	.0414
Association expenses	.0128	.0090	.0073	.0100	.0051	.0029	.0031	.0069	.0024	.0078
Compensation insurance	.0846	.0556	.0675	.0141	.0550	.0568	.0465	.0658	.0857	.0228
Code authority expense	.0158	.0210	.0103	.0088	.0026	.0042	.0035	.0005	.0020	.0021
Depletion[7]	.0396	.1018	.0327	.0549	.0401	.0260	.0389	.0304	.0968	.0515
Total Production Cost	2.7939	3.8996	1.9714[10]	1.2172	1.8614	1.7195	2.0941	1.7441	2.1924	.9429
TOTAL SALES EXPENSE	.1343	.3456	.1449	.1436	.1165	.0726	.1680	.1480	.0544	.1057
TOTAL ADMINISTRATIVE EXPENSE	.1056	.0826	.0757	.0654	.1123	.1061	.1490	.1259	.0643	.0724
Total Cost per Ton	3.0338	4.3278	2.1920	1.4262	2.0902	1.8982	2.4111	2.0180	2.3111	1.1210[14]
INCOME FROM COAL SALES										
Pre-code price sales	2.3212	3.0162	2.0273	1.5161	1.8668	1.7167	2.3404	1.6683	2.6391	.9729
Orders under code prices	3.1121	4.0426	2.6636	2.0252	2.6714	2.7430	2.7047	2.5397	3.4754	1.6059
Shipments to storage[8]	.....	.....	.....	.....	2.7029	.....	.....	2.7503	2.7114	.....
Coal to beehive ovens and briquet plants	.....	.....	.....	.....	1.4548	.....	1.4388	1.2120	3.0677	.....
Mine sales to dealers and retail customers[9]	3.2119	.....	2.7236	2.0367	3.3501	3.5075	3.1062	2.2196	3.5805	1.3309
Used for mine power and/or heat	1.8973	1.6074	1.5423	1.0897	1.4186	1.2536	1.6226	1.1462	1.6850	1.0000
Total Income From Coal Sales	2.6959	3.9673	2.2971	1.6932	2.3494	2.2611	2.5987	2.2615	2.9233	1.3465

[1]Does not include Arkansas anthracite.
[2] to [9] See footnotes to Table II.
[10]Includes .0036c track expense
[11]Missouri, southeastern Kansas and Henryetta-McAlester (Okla.) districts.
[12]Does not include North Dakota stripping, but does include Montana, central New Mexico and Wyoming, for which the data reported to NRA represented only a small percentage of the total November production in the areas named.
[13]Covers 16 mines, including 4 mines classified as part captive and part commercial.
[14]Includes 3.197c prepaid stripping costs.

per cent in the Southwestern subdivision. Data for only part of Division V had been released at the time this story was written. These data showed 5.9 per cent of the Washington workers receiving less than $30 and 86 per cent receiving $40 or more. For Utah the figures were 9.9 and 77.3 per cent, respectively; for central New Mexico, 26.5 and 57.5 per cent, respectively.

Six mining engineers made the study of the effect of a shorter work-day and a shorter work-week called for in the provision of the code quoted in a preceding paragraph. Because of the limited time available, no attempt was made to accumulate data for each mining district as a whole; 15 operations in Division I, 5 in Division II, 4 in Division III, 5 in Division IV and 8 in Division V were selected by the engineers as representative of the producing fields involved and the November costs at these mines were used as a basis for answering the question raised by the code.

The answer given in the report of these engineers was distinctly negative. Using an 8-hour 5-day week as the norm and rejecting the assumption that a shorter work-day would mean an increase in the tonnage loaded per hour, the committee concluded that the costs would be prohibitive. Because of the seasonal character of the industry in many districts, the committee felt that the code provisions on maximum hours per week should be flexible in order to take care of brief periods of peak demand. "Should a reduction in working hours per week be imperative," said the report, "it should be made in the number of days per week rather than in the hours per day.

"A reduction in hours per day with the existing daily wages would result in a substantial increase in the cost per ton. This would place an additional financial burden on the consuming public, who would turn more and more to competitive fuels, thus further decreasing the opportunity for employment of labor in this industry. A reduction in hours per day with existing hourly rates would result in an economic loss to both employers and employees—to employees due to the necessary additional number of starts in order to maintain the present weekly wages; to employers due to the necessary additional development and general overhead to maintain the present weekly tonnage. Even though the output be proportionally reduced, the overhead costs will be materially increased."

In addition to these direct costs, summarized in Tables VI and VII, the engineers also declared that a reduction in hours per day would entail increased capital expenditures for plant and equipment to maintain the existing rate of daily output. These expenditures for typical operations, it was estimated, would range from 25c. to $1.11 per ton of annual capacity.

TABLE VI—ESTIMATED VARIATIONS IN TOTAL COST, IN CENTS PER TON, ON BASIS OF PRESENT HOURLY RATES FROM COSTS BASED ON EIGHT-HOUR DAY AND FIVE-DAY WEEK

Mine Location and Daily Capacity	Six Days per Week			Five Days per Week		Four Days per Week			Three Days per Week		
	8 Hr.	7 Hr.	6 Hr.	7 Hr.	6 Hr.	8 Hr.	7 Hr.	6 Hr.	8 Hr.	7 Hr.	6 Hr.
Division I											
Tioga C'ty, Pa. (625)*	*11.4*	*5.7*	*2.2*	7.1	16.7	17.1	26.4	38.5	46.2	58.6	76.9
Cambria C'ty, Pa. (3300)	*8.4*	*4.7*	*0.7*	4.8	11.2	12.8	19.0	27.1	34.0	42.5	53.5
Indiana C'ty, Pa. (3205)	*9.2*	*4.0*	16.0	5.3	12.1	12.6	19.3	28.0	33.5	42.4	54.9
Allegheny Valley, Pa. (1940)	*9.7*	*5.4*	*0.2*	5.1	12.0	13.5	21.2	30.1	38.6	47.6	59.8
Thick Freeport (2400)	*9.2*	*4.4*	*1.6*	5.6	19.0	13.9	20.9	30.3	36.9	46.5	59.1
Washington-Greene (3350)	*6.3*	*5.1*	*4.6*	3.6	8.5	9.4	14.1	20.2	25.0	31.4	39.8
Pittsburgh Coking (4200)	*5.9*	*3.1*	*0.7*	3.5	8.0	8.8	13.2	19.0	23.6	29.4	37.3
Ohio No. 8 (3200)	*3.7*	*1.9*	*0.6*	2.4	5.6	5.6	9.1	12.4	15.0	18.9	24.1
Northern West Va. (1400)	*6.8*	*3.0*	*1.5*	4.1	9.8	9.8	15.3	22.5	26.2	33.9	43.6
So. Low-Volatile (1000)	*7.4*	*3.4*	*2.0*	4.5	11.8	11.1	17.5	26.2	29.2	38.5	50.7
Pocahontas (2500)	*4.2*	*3.5*	*1.3*	4.8	11.4	10.6	16.5	24.4	28.7	36.6	47.1
New River (1500)	*6.1*	*4.3*	*0.9*	3.2	9.3	9.2	12.1	20.8	24.1	28.5	40.4
Logan (1250)	*6.3*	*2.8*	*1.4*	3.2	9.7	9.6	14.9	22.1	25.6	32.9	42.6
Hazard (1600)	*6.3*	*2.2*	*1.9*	4.0	11.6	9.6	15.6	24.1	25.4	33.5	44.7
Western Kentucky (1225)	*5.1*	*2.8*	*0.1*	2.8	6.7	7.9	11.5	16.5	20.7	25.6	33.0
Division II											
Iowa (475)	*13.3*	*5.3*	*6.0*	10.4	22.8	14.3	33.6	51.2	55.7	72.4	95.1
Northern Illinois (3225)	*8.0*	*4.6*	*0.1*	4.2	9.8	11.9	17.5	25.1	36.2	43.7	54.0
Southern Illinois (4500)	*5.0*	*2.8*	*0.4*	2.6	4.8	7.6	10.8	15.2	20.3	24.7	30.9
Belleville, Ill. (2600)	*6.2*	*4.5*	*1.9*	3.6	5.8	9.8	13.1	17.5	25.8	30.5	36.9
Terre Haute, Ind. (2400)	*5.0*	*3.3*	*1.0*	2.2	5.1	7.1	10.3	14.2	19.9	24.0	29.0
Division III											
Walker C'ty, Ala. (1150)	*8.8*	*3.9*	*2.0*	6.0	13.6	14.1	21.7	31.7	36.9	47.3	61.6
Shelby C'ty, Ala. (550)	*9.7*	*5.5*	*1.1*	4.8	10.8	14.2	20.0	27.6	38.2	46.4	58.8
Jefferson C'ty, Ala. (1000)	*6.6*	*3.5*	*0.5*	3.8	9.2	9.6	15.2	22.2	26.0	33.3	43.6
Marion C'ty, Tenn. (1450)	*7.7*	*4.5*	*0.5*	4.2	9.3	11.5	17.0	23.9	30.6	38.1	48.1
Division IV											
Kan.-Mo. Stripping (880)	*4.4*	*2.5*	*0.2*	2.7	6.3	6.8	10.6	15.3	18.2	23.5	27.6
Kansas (412)	*3.4*	*2.2*	*0.4*	1.7	4.3	5.1	7.5	11.0	13.6	17.1	21.3
Missouri (209)	*4.5*	*2.2*	*0.7*	2.9	6.8	6.7	10.4	15.4	17.7	22.0	30.4
Oklahoma (236)	*7.0*	*5.5*	*4.6*	3.3	6.6	10.3	14.8	19.8	26.8	32.7	42.3
Arkansas (210)	*6.8*	*4.4*	*1.3*	3.8	7.3	10.4	15.4	22.0	27.5	35.4	45.1
Division V											
New Mexico (1000)	*6.1*	*3.2*	*0.1*	3.6	8.4	9.2	14.1	20.4	24.5	31.4	41.6
Colo. Lignite (1250)	*4.6*	*2.7*	....	2.6	6.0	7.0	10.6	15.1	18.7	23.7	30.5
Colo. Bituminous (900)	*9.8*	*6.4*	*1.6*	3.6	9.5	11.7	17.8	25.3	33.3	41.1	52.0
Wyoming (1200)	*6.8*	*3.7*	*0.2*	3.7	8.7	9.8	14.5	22.9	27.6	35.0	45.5
Utah (1050)	*7.9*	*4.4*	*0.5*	4.5	10.7	12.2	18.1	26.1	32.1	40.5	51.5
N. Dakota Stripping (1150)	*4.7*	*2.0*	*0.9*	3.1	7.0	6.8	10.0	15.5	18.2	23.6	30.7
Montana (1450)	*7.3*	*3.8*	*1.1*	4.6	10.5	11.0	16.9	24.6	29.1	37.2	48.1
Washington (700)	*11.1*	*6.0*	*0.7*	6.4	15.2	16.6	27.0	38.4	44.0	56.3	72.2

Italics indicate decreases. *Actual capacity of mine is 1,500 tons per day, but output, says report, is limited to 625 tons because of labor shortage.

TABLE VII—ESTIMATED VARIATIONS IN TOTAL COSTS, IN CENTS PER TON, ON BASIS OF PRESENT DAILY RATES FROM COSTS BASED ON EIGHT-HOUR DAY AND FIVE-DAY WEEK

Mine Location and Daily Capacity	Six Days per Week			Five Days per Week		Four Days per Week			Three Days per Week		
	8 Hr.	7 Hr.	6 Hr.	7 Hr.	6 Hr.	8 Hr.	7 Hr.	6 Hr.	8 Hr.	7 Hr.	6 Hr.
Division I											
Tioga C'ty, Pa. (625)*	*11.4*	21.4	65.3	34.5	80.6	17.1	54.3	103.6	46.2	87.4	144.2
Cambria C'ty, Pa. (3300)	*8.4*	12.6	41.1	22.4	52.3	12.8	37.0	69.3	34.0	61.4	97.8
Indiana C'ty, Pa. (3205)	*9.2*	8.0	29.5	17.4	40.5	12.6	31.7	57.1	33.3	55.4	85.3
Allegheny Valley, Pa. (1940)	*9.7*	7.8	31.1	18.8	43.9	13.5	35.3	63.2	38.6	62.8	95.2
Thick Freeport (2400)	*9.2*	11.0	37.6	21.3	55.8	13.9	37.2	68.2	36.9	63.6	99.0
Washington-Green (3350)	*6.3*	12.8	46.6	21.9	51.1	9.4	32.7	63.5	25.0	50.5	84.4
Pittsburgh Coking (4200)	*5.9*	9.6	30.2	16.3	37.9	8.8	26.4	49.7	23.6	43.2	69.4
Ohio No. 8 (3200)	*3.7*	10.0	28.7	14.4	33.8	5.6	21.4	41.1	15.0	31.6	53.6
Northern West Va. (1400)	*6.8*	9.5	30.7	16.6	39.2	9.8	28.2	52.3	26.2	46.9	74.1
So. Low-Volatile (1000)	*7.4*	7.8	28.2	15.7	38.1	11.0	28.9	52.9	29.2	50.2	77.6
Pocahontas (2500)	*4.2*	8.7	29.7	16.8	39.2	10.6	29.2	53.8	28.7	49.5	77.4
New River (1500)	*6.1*	9.8	33.8	17.4	42.4	9.2	26.6	54.3	24.1	43.2	74.2
Logan (1250)	*6.3*	9.9	31.0	16.0	39.6	9.6	28.0	52.3	25.6	46.2	73.4
Hazard (1600)	*6.3*	10.4	31.4	16.7	41.2	9.6	28.5	54.0	25.4	46.6	74.8
Western Kentucky (1225)	*5.1*	8.1	25.6	13.9	32.4	7.9	23.0	42.9	20.7	37.4	60.0
Division II											
Iowa (475)	*13.3*	14.0	50.7	29.8	68.1	14.3	52.7	95.8	53.7	91.3	139.3
Northern Illinois (3225)	*8.0*	6.1	25.1	15.3	35.6	11.9	28.9	51.9	36.2	56.7	84.0
Southern Illinois (4500)	*5.0*	5.6	19.4	11.2	25.0	7.6	19.8	36.2	20.3	34.1	53.2
Belleville, Ill. (2600)	*6.2*	9.0	29.7	17.4	38.0	9.8	27.5	51.0	25.8	45.7	72.3
Terre Haute, Ind. (2400)	*5.0*	5.0	18.2	10.7	24.8	7.1	19.1	34.8	19.9	33.4	50.8
Division III											
Walker C'ty, Ala. (1150)	*8.8*	17.1	51.0	26.9	62.5	14.1	42.5	81.4	36.9	69.0	111.9
Shelby C'ty, Ala. (550)	*9.7*	14.0	44.0	24.5	56.4	14.2	41.0	75.4	38.2	67.0	106.5
Jefferson C'ty, Ala. (1000)	*6.6*	19.4	54.2	26.7	62.6	9.6	38.1	75.6	26.0	56.6	97.5
Marion C'ty, Tenn. (1450)	*7.7*	10.1	33.6	18.9	43.9	11.5	32.1	59.0	30.6	53.8	84.4
Division IV											
Kan.-Mo. Stripping (880)	*4.4*	2.5	11.5	7.5	17.4	6.8	15.3	26.5	18.2	28.3	38.7
Kansas (412)	*3.4*	17.1	44.7	21.1	49.3	5.1	26.8	56.0	13.6	36.5	67.4
Missouri (209)	*4.5*	15.1	41.1	20.2	47.2	6.7	27.7	55.6	17.7	39.3	70.9
Oklahoma (236)	*7.0*	12.8	38.1	21.3	49.2	10.3	32.7	62.2	26.8	51.1	85.0
Arkansas (210)	*6.8*	21.8	60.2	30.0	69.0	10.4	41.8	83.5	27.5	61.6	106.3
Division V											
New Mexico (1000)	*6.1*	8.5	27.5	15.4	36.0	9.2	26.0	48.4	24.5	43.5	68.9
Colo. Lignite (1250)	*4.6*	9.9	28.9	15.1	35.1	7.0	23.1	44.5	18.7	36.5	60.3
Colo. Biuminous (900)	*9.8*	5.2	25.5	15.5	37.3	11.7	30.0	53.9	33.3	54.1	82.3
Wyoming (1200)	*6.8*	7.6	26.8	15.3	35.9	9.8	25.9	49.5	27.6	46.4	72.1
Utah (1050)	*7.9*	11.4	37.3	20.5	47.9	12.2	34.3	64.0	32.1	57.1	90.5
N. Dakota Stripping (1150)	*4.7*	2.7	11.9	7.9	18.2	6.8	15.8	27.3	18.2	28.8	42.6
Montana (1450)	*7.3*	7.6	27.8	16.2	37.5	11.0	28.7	52.2	29.1	49.4	76.6
Washington (700)	*11.1*	21.5	64.6	34.0	79.5	16.6	52.9	101.4	44.0	84.5	138.2

Italics indicate decreases. *Actual capacity 1,500 tons; see footnote, Table IV.

NOTES

. . . from Across the Sea

OCCURRENCE of silicosis in British coal mines in which the rocks contain a low percentage of free silica justifies further consideration of the causes of that disease. Most of the evidence as to its source naturally is based on experience in metal mines, where the disease is most prevalent and its cause more readily debatable. W. R. Jones, speaking at the Institution of Mining and Metallurgy and arguing that silicates such as sericite, sillimanite and tremolite caused the disease rather than free silica, gave evidence on this point supplemental to that recorded in *Coal Age*, January, 1934, p. 24.

At Broken Hill mines, New South Wales, the free silica is low, varying from 1.62 to 17.73 per cent, and the rocks adjacent to the ore run only 20 per cent free silica. However, a rock known as sillimanite gneiss, with many fibers of sericite and sillimanite, appears and, according to Dr. Jones, as a result there are many silicotics. On the other hand, the Lonely mine, in South Rhodesia, is a quartz operation where drilling is done dry, no water is sprayed and ventilation is difficult. Yet there are no silicotics.

Many factories in Great Britain, crushing quartz, have never had a case of silicosis. Perhaps the most striking statement Dr. Jones made was that in a Danish factory, crushing cryolite with only 3 per cent of silica, 40 out of 78 men contracted silicosis. Now, cryolite is a fluoride of sodium and aluminum and has no silica in its constitution, so the lungs of the workers could hardly have been cut or poisoned by silica dust. Moreover, cryolite does not appear, from a perusal of Dana's Textbook of Mineralogy, to be found in a fibrous or acicular condition. These facts, on the one hand, seem to throw doubt on the poisonous character of silica and, on the other, to suggest that the action of any hard dust, whether acicular or merely brittle, is likely to cause some form of pneumoconiosis. Strangely, cryolite is not very hard, the hardness being 2.5, whereas that of quartz is 7.

In discussing Dr. Jones' paper, Prof. J. S. Haldane declared that uncombined silica had been charged with causing silicosis not because free silica was found in the lungs of silicotics at death but because men exposed to the dust of free silica for long periods of time became silicotics. In other words, not finding it in the lungs or finding other minerals will not change the record. In contrast with Dr. Jones, he declared that the men who were engaged in the crushing of pure quartz were found to be in great danger of contracting silicosis even though no sericite was present. That danger can be avoided only if scrupulous precautions are taken to keep the dust from the air breathed.

In the workings of the Kolar gold fields, where the rock contains pure silica, it seems to Prof. Haldane that the freedom from silicosis arises from dust derived from the basic hornblende schist, which is broken along with the quartz rock, so that the dust breathed by actual test is only 30 per cent free silica—no more, in fact, than is found in the shale dust present everywhere in British mines, where on an average there is much less phthisis than in average occupations.

Lungs, said Prof. Haldane, cannot be regarded as a sort of geological dust trap. By the action of cells which receive and destroy waste material and by the action of fine hairs, dust is continually being removed from the lungs, so that they do not become choked with the dust breathed. Some dusts also are dissolved by the slightly alkaline liquids in the lung and are carried off in the constant exchange of material occurring everywhere in the human body.

Pure silica dust breaks down this cleansing process, at the same time making lungs susceptible to tubercular infection. Danger arises only with a high percentage of free silica. Silica hydrate derived from the silica, before being dissolved away, is extremely irritating to the lungs, where not "diluted" with other dusts. The reason why Dr. Jones finds such a large percentage of the silicate, sericite, is because sericite is less soluble in the alkaline liquids of the lungs than free silica. Dr. Haldane added that scattered fibrosis often results from breathing excessive quantities of dust, and it gives the same X-ray picture as does real silicosis in its early stages. But this fibrosis does not render the man who has it liable to tubercular infection. It should not be termed silicosis; pneumoconiosis would be a more suitable term.

In the mineral matter of the lungs of deceased silicotics, examined by Dr. Jones, declared Dr. H. H. Thomas, there was between 20 and 40 per cent of silica in excess of the quantity needed to combine with alumina to form sericite. There is, therefore, probably much free silica in the lungs, though it is almost impossible to distinguish it. He added that the Welsh and English carboniferous sandstones, where silicosis occurs, have much more sericite than similar Scottish sandstones, where silicosis is not prevalent.

According to Prof. E. H. Kettle, crystalline silica, when inoculated in the veins, produces lesions. Amorphous silica will not. Very readily soluble silica and silica also that is not soluble do not produce lesions, but in between is a silica that turns the trick. R. J. Lemmon set up pyrite as a chief predisposing cause of silicosis, for iron had been found in all of 29 lungs of deceased silicotics and, in South Africa, Canada, Australia and other countries, silicosis occurs where iron sulphides are encountered in drilling. These pyrites, in presence of silica, grind to finer dust than the silica itself. Iron oxide and freshly formed carbon dioxide may possibly attack minerals in the lungs.

To Sir John Fleet it seems that dusts contain many lung-tissue-piercing bodies, such as sericite of many kinds, mica and fibrous hematite, which latter causes hematitosis. Only the ability of human lungs to throw off such dusts affords them protection in dusty industries. Prof. H. Louis also believes that pyrite may be the cause of silicosis in the Witwatersrand, but, if so, he added, why is silicosis not prevalent in the Huelva pyrites mines? The whole trend of the discussion showed that Dr. Jones' theory that sericite and like bodies are the cause of silicosis is not yet proved to the satisfaction of everybody, that some authorities are doubtful, others distinctly hostile, and still others believe it one of many causes.

DRAWING inspiration from the United States, Great Britain is adopting protective apparel — hats, gloves, shoes, goggles and shin guards —which last are, I believe, something new in American mines. About 5,000 protective hats have been sold. Apparently they are, thus far, not so good as those made in the United States, for they will warp in a hot room and do not cushion a blow as effectively as ours.

Gloves are used by the men who fill coal into cars as received from shakers or conveyors. With protection for the fingers and forearm these men appear to be more willing to roll over the coal into place in the car, thus increasing the quantity carried about 2¼ per cent. The need for protection is not only for the fingers but for the forearm also. For those loaders who handle cars, particularly in tallying them, said H. M. Hudspeth, mining engineer of the Safety in Mines Research Board, a glove which gives freedom for separate action to individual fingers is necessary, but others use mittens. Some men require not only gloves but forearm protection. Hard coals, like anthracite, make strong gloves necessary.

Sometimes, a laced fingerless mitten is used which is reversible end for end, and from front to back, so that it has four wearing surfaces. All classes of laboring men are using these mittens, especially pickmen. Rubber mittens also are used. With pneumatic picks, palmless gloves are favored, and cricketers' batting gloves are being tried by the men who build packwalls. The glove

problem should not be neglected, for hand injuries number 40,000 a year. Major Hudspeth, however, is opposed to an indiscriminate use of gloves, and believes the entire subject should be carefully studied.

For highly inclined seams, non-slip clogs with removable spikes have been invented by a North Staffordshire miner. Non-slip soles are being devised in Lancashire. The shin guards resemble the protection used by cricketers. Miners, said Major Hudspeth, seem to be quite receptive to all these developments.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

The Economics of the Recovery Program, by D. V. Brown, Edward Chamberlin, S. E. Harris, W. W. Leontief, E. S. Mason, J. A. Schumpeter and O. H. Taylor. Whittlesey House (McGraw-Hill Book Co.), New York City. 188 pp. Price, $1.50.

Those hardy souls who still cherish a clandestine fondness for the old order will enjoy these fireside chats of seven Harvard professors who plainly do not think too highly of the economic soundness of the program for recovery launched by Harvard's distinguished alumnus in the White House. The critics of the New Deal whose contributions make up this volume do not shrink from a sympathetic view of the *laissez-faire* theory of economics; on the contrary, their bent is in that direction. While specifically disclaiming any belief that "nineteenth century individualism is the summit of wisdom for all times," the authors have only themselves to blame if they leave the impression that they much prefer the solidity of past experience—even though the experience has been painful—to the thrill and uncertainty of experiment.

Because of this and because the conviction expressed in the opening essay that recovery is sound only when it comes without artificial stimulus, it is regrettable that this opening essay by Prof. Schumpeter on past depressions is developed so sketchily. Condensation has its virtues but brevity can be carried too far when attempting to orient the average reader who has no extensive background of knowledge concerning past industrial history and cyclical depressions. Particularly is this true at the present time when, as in the late New Era, the prophets of the new dispensation exhort the world to forget the past and to disregard its bitter lessons as something beneath the superior wisdom of today.

Passing from the historical perspective, the volume discusses purchasing power, controlling industry, helping the worker, higher prices, helping the farmer, and economics vs. politics. This last essay, by Prof. Taylor, is particularly challenging in its penetrating appraisal of the political limitations on economic action and the economic limitations on political action. Too often this interplay is overlooked by the pure doctrinaire in both camps. Prof. Chamberlin's attack on the high-wage theory, which Prof. Brown directly and Prof. Harris inferentially indorse, might be more persuasive if he did not insist that higher wages necessarily mean higher prices; that is not always true.

The book bristles with such disputatious conclusions. And therein lies its great value to orthodox and heterodox who want to test the validity of their own opinions on the soundness and the efficacy of the recovery program now under way. If the volume is negative in that it offers no detailed plan as a substitute for the policies now being pursued at Washington, it is nevertheless constructive in that it demands that the engineers of the New Deal prove the soundness of their own course of action.—S. A. H.

Explosion at Cardowan Colliery, Lanarkshire, by Sir Henry Walker. British Library of Information, New York City. 22 pp. with two pocket maps. Price, 30c.

This report covers causes of and circumstances attending the explosion of Nov. 16, 1932, and includes testimony and studies made of the gassy conditions and the rock-dusting of points along the face. All the twelve men at the face were involved; four died instantly, five later and three suffered injuries from burns. Two men at the gate-head loader, in the intake air curent, died later; three others, two in the intake airway and one in an extension of the face beyond the intake, were uninjured.

The Coal Mines Order requires that before a shot is fired the place shall be examined in all contiguous accessible places within a radius of 20 yd. Sir Henry Walker, the chief inspector, does not think that compliance was made with this requirement.

The shotfirers evidently were speeding up their work. In August, Fireman Horn and Shotfirer Beaton fired 56 shots daily, and in November, 80. Shotfirer Whiteford in August fired 37, and in November, 67. Beaton had fired as many as 88, and Whiteford, 81. Testimony tended to show that shots could not be fired in a legal manner with that rapidity. There were "cundies," or "open waste" spaces, between packwalls, in front of the longwall face, which would come within the 20-yd. regulation, if accessible, that probably were not examined. The chief inspector believes the examination was not performed in a legal manner.

Apparently the seam sometimes broke after undermining if the "gum" or bug dust was carefully removed, leaving a gap between the hard 6- to 9-in. coal at the top and the coal below. Sometimes, perhaps, this fallen coal had been loaded away, though the evidence given was not definite. It is questioned by the chief inspector whether the firing of a shot in such a thin measure of coal was legal, because the shot was incompletely confined, perhaps by 3½ in. of coal or less.

One fireboss was in the habit of firing two shots simultaneously in brushings, declaring it was the safer manner, because the firing of one shot might remove too much of the material from around the other hole and give it too little work to do, making it a dangerous shot. In coal, apparently, each shot in the coal was fired separately, though the evidence was contradictory.

The Coal Mines Act provides that when "two or more shotholes have been placed in such a manner that the firing of one shot would be liable to relieve any part of the work to be done by another shot, each shot to be fired shall be fired before any of the shotholes is charged." Question has been raised as to the desirability of such a provision, says the inspector, because the first shot makes falls likely and because the atmosphere after that shot is not clear of fumes and the fireboss has to examine for firedamp in a clouded atmosphere. Moreover, the temptation to fire a shot which has little work to do is removed, less explosive is needed and the brushing is brought down cleaner and with less shattering of sides.

In the chief inspector's opinion the contentions have merit, but the risk of firing many shots simultaneously may result in misfires of one or more shots. Firing of shots in the coal at Cardowan Colliery has been discontinued. The reviewer would add that shooting was done while other men than the fireman and shotfirer, presumably loaders, were still at the longwall face; the shooting battery was found only 6 ft. and 10 ft. respectively from two shots, one of which caused the disaster.—R. DAWSON HALL.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

■

Capacitor Investment Will Earn Nearly 100 Per Cent First Year

INVESTMENT in power-factor-corrective equipment, as a rule, will prove profitable even if there is no power-factor clause in the rate schedule. By reason of the lower current, the power losses in lines, transformers and motors are reduced and the capacity of the equipment is increased. Although the technical electrical engineer usually appreciates the existence of these intangible savings, the accountant is not likely to be impressed. But when a purchased-power rate allows a definite percentage of premium for operation above a certain power factor or exacts a penalty for operation below that value, there can be no argument as to the saving, not including those intangibles resulting from lower current in the electrical equipment.

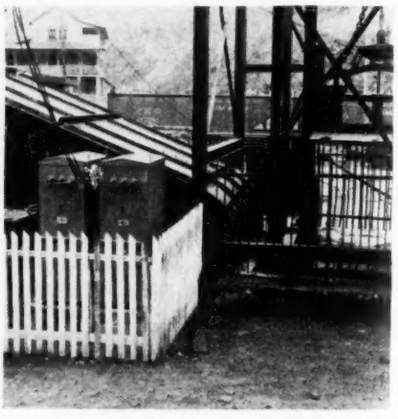
A few years ago the Island Creek Coal Co., which for many years purchased power on a schedule devoid of a power-factor clause, switched to the "Tariff L M P" offered to "large mine power" users, and thus for the first time became vitally concerned with the power factor of its load. Substation equipment of the company consists for the most part of rotary converters, and, although this type of equipment is in itself favorable to operation at reasonably high power factor through a wide variation of load, it affords no source of reactive power to compensate for the inherently low power factor of an induction motor load. The average power factor of the company load was running about 75 per cent, and during periods of favorable operation would reach 89 per cent. In the rate schedule, 85 per cent is fixed as the point without penalty or bonus. During the past year, parallel-connected three-phase capacitors were installed at each mine, with the result that the average power factor often reaches 99 per cent, and for one month it reached 99.5 per cent.

An estimated direct monthly saving of $643, as calculated by engineers of the capacitor manufacturer, is being exceeded. Within thirteen months from the date of installation the savings will have exceeded the total cost of all of the equipment including the installation charges.

At the five Logan County (West Virginia) mines now in operation there was installed a total of ten capacitors, each rated at 70 kva. This condenser load of 700 kva. was distributed equally at each mine; in other words, two 70-kva. capacitors were installed at each.

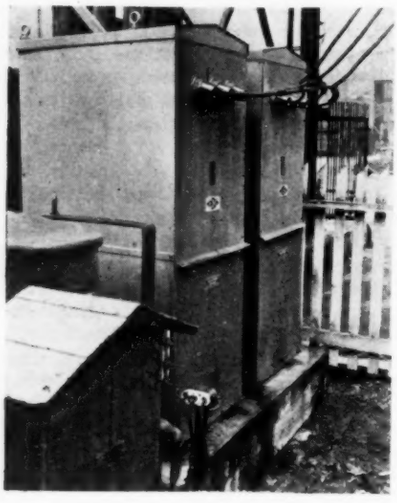
In each instance the capacitors are located beside a transformer bank which reduces the voltage from 6,600 to 440 for power supply to conveyors, tipple motors, fan and so on. Capacity of certain transformer banks is 300 kva.; others, 225 kva. In line with recommendations of the manufacturer, 440-volt capacitors were purchased instead of equipments designed for 6,600 volts. Lesser chance of damage by lightning was the principal reason for choosing capacitors for connection to the low-voltage side. Transformer banks operate at approximately full load for 12 hours and at approximately one-half capacity for the remaining 12 hours.

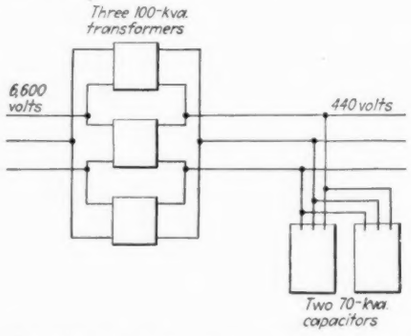
Outdoor-type steel cabinets housing the capacitors are fitted with 150-amp. 440-volt triple-pole quick-break knife switches which are mounted in the base. The cabinet affords sufficient extra space so that additional condenser units can be added to increase the capacity from 70 kva. up to



Installation Beside Fan at Auxiliary Shaft, Mine No. 21.

Capacitor Connections and Cabinet Construction.





Capacitors Are Connected in Parallel on Low Side of Transformers.

100 kva. Base dimensions of the capacitor are 28x40 in. and the height is 83½ in.

Installation cost was small because the capacitors are mounted on concrete bases which extend only about 10 in. above the ground. Steel cabinets are electrically grounded, and on them are mounted plates carrying the reminder that it is necessary to discharge the condenser before handling. Fences surround the equipment, including the transformers. All of the capacitors were made by the Electric Machinery Manufacturing Co., Minneapolis, Minn.

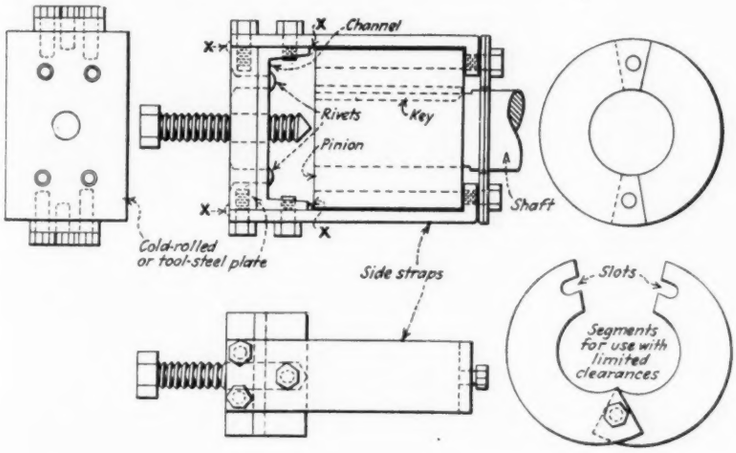
At the end of the regular working period each day the chief electrician of the coal company reads a Westinghouse Type RI meter which records the kilowatt-hours, kilovolt-amperes and kilowatt demand. Thus any irregularities can be detected and investigated immediately.

Pinion Puller

John J. Nolan, Terre Haute, Ind., offers the pinion puller shown in the accompanying illustration as a means of eliminating the tendency of puller arms or straps to spread when pressure is applied. This is accomplished by the use of two segments, or plates, which fit around the shaft back of the pinion and are bolted to the ends of the puller side straps. The segments are made of light steel plate, and in case the clearance back of the pinion is limited, slots may be cut in the plates as shown to allow them to be closed under the cap screw already in place on one of the puller arms, after which the screw may be run down to hold the segments in place. This allows the segments to be used where there is not sufficient room for inserting the cap screw after the puller is in place, and also reduces the size of the various puller parts.

Construction of the puller proper is such that it may be used for different sized pinions by removing the side straps and inserting spacer plates and longer cap-screws. If it is to be used on only one pinion, however, the puller may be welded permanently at the points denoted by *X* on the sketch. By the use of hooked side straps without the segments, the puller also may be used for removing pulleys (*Coal Age*, August, 1933, p. 276).

Construction Details of Pinion Puller.



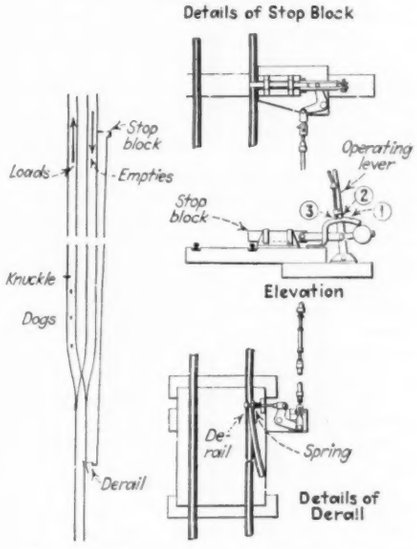
Getting the Jump!

Regular study of the Operating Ideas offered every month in these pages should enable the practical operating, safety, electrical or mechanical man to avoid much wasted mental and physical effort. The problem he may be called upon to solve, sometimes at a moment's notice, may have been encountered already by some one at another mine and its solution set forth here for immediate or future use. The experience of others is thus made available to you. Likewise, they may have a use for ideas which you have developed to meet the unexpected or smooth the path of normal operation. This department is designed to present such ideas, so send yours in. A sketch or photograph may help to make them clearer, and *Coal Age* will pay $5 or more for each that is acceptable.

Handling Trips on Inclines

For handling trips at the tops of inclines and preventing damage from runaways, the Lancashire and Cheshire Safety in Mines Research Committee, in Pamphlet No. 4 (Haulage Series), recommends the control system shown in the accompanying illustration. The equipment consists essentially of a stop block and spring derail which requires the attendant to make use of them every time a trip is lowered. Distance between the stop block and the derail is slightly greater than the length of the trip. When a trip is to be lowered, the block is withdrawn from the rail by placing the operating lever in the No. 3 notch. Through a system of bell-cranks and levers, this also opens the derail. Should any of the cars run away through being uncoupled or not attached to the rope, or through breakage, they are caught at the derail, where the rib or side may be especially prepared to receive them.

If everything is in order, the trip is lowered to the intermediate position and the stop block is placed in the full "on" position by placing the operating lever in the No. 1 notch. This automatically closes the derail and allows the trip to proceed. After the trip has passed the derail, the operating lever is placed in the No. 2 notch, which opens the derail about ¾ in. but leaves the stop block in position to catch cars that may be out of control for any reason. The derail being held in open position by a spring, loaded trips trail it without difficulty, leaving it in position to catch any loads that may break loose above that point.

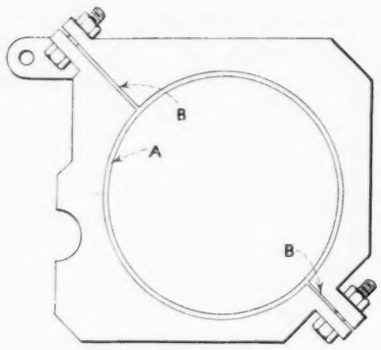


Control System for Use at the Tops of Inclines.

Housing Difficulty Fixed by Slight Cut at Joint

If a locomotive is allowed to operate for a time with the motor-housing bolts loose, the fit between motor and bearing housings soon wears so that it is no longer tight even if the housing bolts are pulled snug. If that happens or if the original fit was not as tight as it should have been, the condition continues to grow worse, and something must be done. The common practice is to add material to the housing fit, by welding or brazing, and then machine the part to the desired size. If machined to standard it may be necessary to go through the same process to bring the bearing housing to standard. If a worn bearing housing is to be used without change, the motor housing must be machined to a diameter less than standard.

If bearing housings are to be interchangeable, as is necessary when spare armatures are sent out with ball bear-



Locomotive Motor Housing.

ings assembled, it is, of course, necessary also that all parts be maintained to the original or some other standard. Adding metal and machining are rather expensive and demand the attention of an accurate workman to set up the housing properly for machining and to work to the proper fit. As an alternative to filling and welding, there is the method being used at the Chattaroy (W. Va.) mines of the Norfolk & Western Ry. fuel department. Instead of reworking the bearing housing fit (*A* on the sketch), the change is made on the housing faces, *B*. A sixty-fourth of an inch or less, depending on the amount required to clamp the bearing housing tightly, is planed from the surface.

At Chattaroy the first motor housing was repaired in this fashion somewhat over a year ago. Since then eight motors have been thus treated.

D.C. Equipment Performance Checked Against Tonnage

In mines where all of the coal is cut, drilled, gathered and hauled by electrical equipment, the number of direct-current armatures in use is large compared to mines in which the drilling is done by hand and the gathering done, perhaps, with stock. The Island Creek Coal Co. mines in Logan County, West Virginia, are of the first class; hence armature-winding maintenance is a considerable item. Efforts are directed toward improving the operating conditions and improving the repair and maintenance methods to reduce the number of rewinds as measured against the coal tonnage produced.

During 1933 the main shop rewound 127 direct-current armatures, including armatures from main haulage and gathering locomotives, main and travel motors of mounted cutting machines, main and travel motors of mounted coal drills, pump motors and cable-reel motors. The tonnage mined per armature rewind was 28,800. Of the 127 armatures rewound, 28 were 275-volt and 99 were 550-volt.

Including only the main armatures of mining machines and main armatures of haulage and gathering locomotives, the tonnage per rewind was 51,000. Tonnage figures per rewind divided as to the two voltages are not available but no doubt would show the marked advantage of the 275-volt equipment.

Creek Covered to Increase Coal Storage Space

Seasonal storage of slack and, in some cases, mine-run is advantageous under certain conditions. Usually the cheapest method is by belt conveyor direct from tipple to storage pile, but in many cases sufficient ground space is not available within practicable "conveyor distance." Especially is this true in rough country where the valleys are narrow. This difficulty, however, is being overcome at a mine in Logan County, West Virginia, by construction of a reinforced-concrete culvert for the creek, making available for coal storage all of the space formerly occupied by the creek bed.

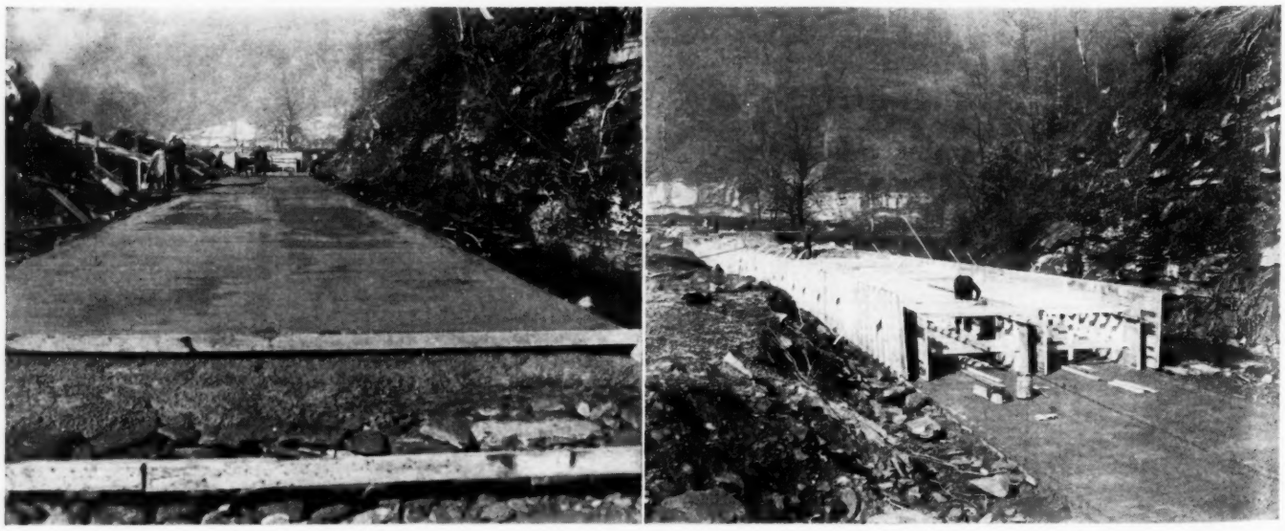
The stream is thus being confined and covered for a distance of 720 ft. Because a 6-ton reclaiming loader will at times operate on top of the culvert, and the coal is piled 44 ft. high, the culvert is designed with a supporting wall through the center. The inside dimensions of each of the two channels is 4 x 4 ft. The bottom mat of concrete is 10 in. thick and the partition wall and side walls are each 12 in. thick. Only the top slab, 14 in. thick, is reinforced with steel. A 4-2-1 concrete is used for all parts.

From Tipple to Storage Pile by Portable Belt Conveyors.

The construction is simplified materially by first putting down a mat of concrete to serve as the bottom of the channels and as the foundation of the walls. As soon as this sets, the wood forming is built directly on top of the mat. Because of the thick walls and low height, no reinforcing tie is used between walls and mat.

By piling the coal 44 ft. high, storage space for 125,000 tons will be made available within 500 ft. of the tipple. Portable belt conveyors carry the coal (mine run) direct from tipple to storage pile. The piling is done in two 22-ft. layers. In several years of storage experience at this mine no difficulty from heating of the coal has been experienced.

Left, Laying the Bottom Mat Is the First Operation; Right, Forms for the Side Walls and Top Slab Are Built After the Bottom Concrete Has Set.



Substantial Reductions in Power Cost Possible With Proper Demand Limitation

LOAD FACTOR (the ratio between average and maximum plant demand for a month, as measured by the demand meter) is not a purely electrical term but can be applied to almost any activity, declared O. G. Crow, West Virginia Engineering Co., Bluefield, W. Va., in discussing "Demand Limitation" at the recent meeting of the New River and Winding Gulf Electrical and Mechanical Institute. As an example of load factor and its determination in which electricity does not enter the picture, it may be assumed that a mine uses 100 mules which work six hours continuously per day and then rest 18 hours per day in a continuous cycle for the 730 hours in an average month. The mules' monthly load factor would then be 25 per cent, obtained by dividing the product of 100 mules and 182½ hours by the product and 730 hours. Suppose 50 of the mules are disposed of and it is desired to accomplish the same amount of work as before.

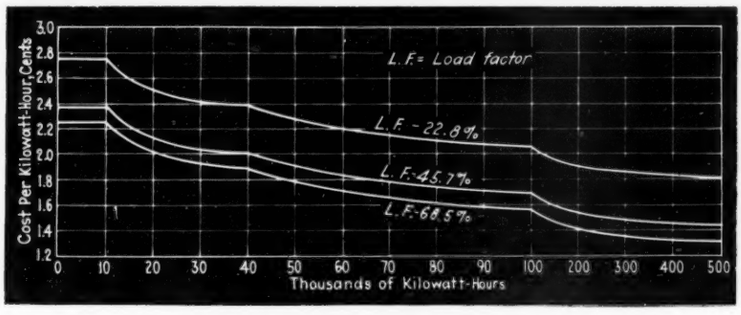


Fig. 1—Cost per Kilowatt-Hour at Various Load Factors.

How can it be done? Simply by working the remaining 50 mules twice the number of hours, which increases their load factor to 50 per cent. Also, feed, etc., for 50 mules would be only one-half that required for 100, yet the same amount of work would be accomplished.

The reasoning used in the case of the mules also can be applied to the mine power load. One mine may have a kilowatt demand of 100, and use it only six hours per day or, possibly, fifteen minutes, per day, with a monthly kilowatt-hour use of 12,166. A certain amount of work is accomplished with the 12,166 kw.-hr. Another mine may have a demand of only 50 kw., use the same number of kilowatt-hours and accomplish the same work. The load factor at the latter has increased to 50 per cent and, as the demand has decreased to one-half its former value, the demand charge also would decrease 50 per cent, just as the cost of feeding the mules decreased. At the same time the total cost per kilowatt-hour would be less, due to the increased load factor.

Load factor and its relation to kilowatt-hour cost on the "L.P." (large mine power) tariff, which applies to purchases by the majority of southern West Virginia mines, can best be shown by the curves in Fig. 1, which show total cost per kilowatt-hour for any number up to 500,000 at load factors of 22.8, 45.7 and 68.5 per cent. Load factors of mines will average from 20 per cent in the lower tonnage classes up to 50-60 per cent in the higher tonnage classes. These are average figures, and do not mean that the larger mines necessarily have the better load factors.

Taking as examples three mines each purchasing 100,000 kw.-hr. per month, reference to the curves shows that Mine No. 1, with a load factor of 68.5 per cent, has a 200-kw. demand, an energy cost of 1.31c. per kilowatt-hour, and a total cost of 1.56c. per kilowatt-hour. Load factor at Mine No. 2 is only 45.7 per cent. Demand at this mine would be 300 kw.-hr., energy cost 1.31c. per kilowatt-hour, and the total cost would increase to 1.68c. per kilowatt-hour. Demand at Mine No. 3, with a very low load factor of 22.8 per cent, would be 600 kw., energy cost would remain at 1.31c., but total cost would increase to 2.06c. per kilowatt-hour, 32 per cent over the cost at Mine No. 1. Supposing further that each mine used an average of 5 kw.-hr. per ton, or that each mine produced 20,000 tons per month, the power cost at Mine No. 3 would be 32 per cent greater than at Mine No. 1, even though the actual kilowatt-hours was the same in each case.

The horizontal line in Fig. 1 represents a total cost of 2c. per kilowatt-hour. As pointed out above, the largest consumer of power does not always have the lowest total cost per kilowatt-hour, even though the energy cost always is lower. For instance, a small user consuming 40,000 kw.-hr. per month at a load factor of 45.7 per cent will have the same total cost (2c.) as a larger mine purchasing 125,000 kw.-hr. at a load factor of 22.8 per cent.

There are three general methods of improving load factor: (1) Increase kilowatt-hour use and maintain the same plant load; (2) spread the plant load over a 24-hour period so that the load or demand for any 15-minute period will be reduced; (3) employ demand limitation by cutting off a part or all of the plant load when demand reaches a predetermined value. It would be foolish to increase kilowatt-hour consumption per ton merely to improve load factor. Even though the actual unit cost would be reduced, more kilowatt-hours would be required and consequently the cost would be higher. Therefore, improving load factor by greater consumption would not be economical unless these additional kilowatt-hours could be made to perform useful work.

Much can be accomplished in the improvement of load factor by transferring as much of the operating load as possible to off-peak periods or by spreading the load more evenly over the entire 24 hours. Operating cutting machines, pumps, etc., at night after haulage has ceased and the tipple has shut down should be resorted to as much as possible. The increase, if any, in labor cost will determine the economy of such changes.

Even after shifting and spreading of loads has been completed, it has been found that there are still a few demand peaks during the month that lessen the load factor and increase kilowatt-hour cost. In order to overcome this condition, a number of plants have installed demand limiters.

Application of demand limitation requires an extensive analysis of the load at each mine. From the physical standpoint, the magnitude and frequency of abnormal peaks determine the advisability of demand limitation. This point may be more clearly understood by a study of Fig. 2, reproducing on a larger scale the usual chart obtained from a graphic demand meter recording the normal mine load over a 24-hour period.

It will be noted that there are four peaks during the day above 420 kw., the maximum being 540 kw., and, further, that there are fourteen peaks above 400 kw. Therefore, in selecting an arbitrary point of interruption, it seems that the demand value of 425 kw. may be near the proper place. If the limiter is set at this value, four interruptions will be required per day. The longest will be 3.2 minutes, the total for the four will be 9 minutes, and the average, 2.25 minutes. Therefore, due to the intensity and the infrequency of these peaks, together with the relatively small time loss involved, it appears that a demand limiter could be used successfully without curtailing production. The mine in question is operating twenty days per month, hence there would be six idle days and four Sundays in a 30-day month. Power use per month would average about 130,000 kw.-hr.; load factor would be approximately 33 per cent; and the total cost per kilowatt-hour, on the "L. P." tariff, would be 1.757c. Substation capacity operated during the day totals 400 kw. in the form of synchronous converters, in addition to the following constant loads: tipple, 80 kw., a.c.; fan, 20 kw., a.c.; day lighting, 20 kw., a.c. Major a.c. pumping load already has been shifted to the off-peak period. D.c. circuit breakers on the substations are of the automatic type.

A demand limiter for this plant could be installed as follows: Place the meter

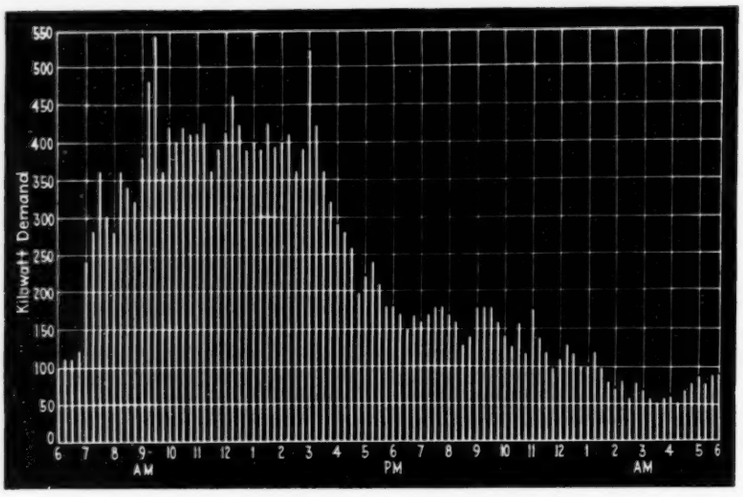


Fig. 2—Integrated Demand Chart for Typical Mine Load.

in the main incoming circuit so that it will measure all the power purchased. Connect relays through the necessary control lines so that when the predetermined demand of 425 kw. is reached, the automatic d.c. breakers will be opened in the substation and a signal sounded at the tipple. The tipple operative would immediately shut down all the equipment while the signal sounded—in this case, a maximum of 3.2 minutes.

After the breakers are opened at the substation and the tipple is shut down there would remain a coasting load of 60 kw. divided equally between the substation, fan and day lighting loads. The remaining load, of course, would tend to increase the demand until the end of the 15-minute period, but at a much slower rate than the total load would have increased it. During the maximum interruption of 3.2 minutes, a load of 60 kw. would increase the demand from 425 kw., the point of interruption, to 437.8 or, say, 438 kw., which would be the ultimate travel of the demand, as compared with the former value of 540 kw. After the delay of 3.2 minutes, or at the end of the 15-minute period, the limiter would reset to zero, the automatic d.c. breaker would reclose, the signal at the tipple would be silent and normal operation would be resumed.

In the latter case the monthly demand would be 438 kw. instead of 540 kw. Practically the same number of kilowatt-hours, 130,000, would be used during the month and the load factor would be increased from 33 to 40.7 per cent. Total cost per kilowatt-hour would be reduced from 1.75c. to 1.65c. or an actual reduction in the total bill of $127.50 per month, or $1,530 per year. A simple installation of this nature usually can be made for $250 or less.

The arrangement outlined in the preceding paragraphs probably is the simplest form of application. Many variations are possible, some of which tend to make operation more positive and beneficial, while others work in the opposite direction. The perfect application would include placing the limiter in the main incoming circuit so that all of the power would be metered, with the auxiliary relays connected so that all loads at the plant would be cut off when the predetermined demand had been reached. The demand in this case would never exceed the predetermined value. This application would be impracticable, of course, at the majority of mines in that too much time would be lost in getting substations and other equipment started again. Also, in most cases, it is impractical to shut down the fans even for periods of two or three minutes.

Measurement of 100 per cent of the power and an interruption of about 50 per cent of the load would tend to decrease the demand to some extent, though the coasting load would be rather heavy and the ultimate demand would be at a value about half way between the point of cut off and the value that would have been reached without limitation. In special cases it may be feasible to measure and interrupt only a portion of the load. This could be true in the case of a mine with an isolated substation, though results obtained would not be very satisfactory. Numerous interruptions could possibly occur without definite results being obtained. Therefore, it may readily be seen that the most definite results and greatest reduction in cost will be obtained when 100 per cent of the power is metered and the loads interrupted are as near 100 per cent of the total as is practicable.

Other variations on standard devices include: (1) double contacts and (2) selective control, either automatic or manual. The first contemplates the use of a double set of contacts on the meter so that when the first set operates, some of the less important loads about the plant are interrupted. Then if the demand continues to increase to the value for which the second contacts are set, all the rest of the load that is practicable to interrupt will be cut off. In many cases this permits the less important loads to suffer the greatest time delay, interrupting the more important loads only in case of an abnormal peak.

A study of the number of interruptions and their duration at a mine where a limiter is in use will very often reveal some interruptions of very short duration each day. In addition, it will be found that these short interruptions are of no benefit toward reducing the demand, especially where the coasting load is unusually heavy. This is occasioned by the fact that the ultimate travel of the demand without the short interruptions would have been no greater than the ultimate travel with the coasting load during a period of maximum interruption. To illustrate this point the following case may be assumed: Maximum peak without limitation, 600 kw.; contacts set to operate at 450 kw.; coasting load, 150 kw.

On the maximum peak the meter would advance at the rate of 40 kw. per minute and would reach 450 kw. at the end of 11.25 minutes. The coasting load of 150 kw. would make the ultimate travel 487.5 kw. at the end of 15 minutes. An ultimate travel of 487.5 kw. for the total load in 15 minutes would require an advance on the meter of approximately 32.5 kw. per minute and at this rate it would reach the point of cut-off at the end of 13.8 minutes. However, it has been shown that the ultimate travel in a case of this type will not exceed 487.5 kw. Hence there is no occasion for having any interruptions at all of less than 1.2 minutes' duration.

To prevent these short interruptions, it is possible to place a set of contacts on the timing disk of the limiter or on an ordinary electric clock so that even though the contacts in the limiter operate after 13.8 minutes has elapsed, the auxiliary relays will not operate, and hence there will be no interruption. The addition of such a device to any limiter at a mine where there is considerable coasting load usually will reduce the number of interruptions 40 to 50 per cent and still prevent high demands.

In case power interruptions are accomplished manually—i.e., a signal is sounded and a substation attendant opens the switches on various circuits—the automatic method mentioned above may be accomplished manually. This is done by installing an electric clock and observing from it, as soon as the signal is sounded, the number of minutes that would be required by the interruption. Then in event the time is less than 1.2 minutes (in the case described only) it will not be necessary to remove any load. In case it is greater than 1.2 minutes, the load can be removed as required; the less important loads first.

Actual results at numerous mines throughout this field and in other fields served by the West Virginia Engineering Co. show that the reduction effected by aid of demand limitation will average from 20 to 25 per cent of the original demand. This reduction at mines with an average load factor usually effects a reduction of 8 to 10 per cent in the total bill. Where other than "L. P." tariffs are applicable, the reduction would be greater or less, depending on the ratio of the demand charge to the total charge.

WORD from the FIELD

New Preparation Facilities

New contracts and construction of preparation-plant facilities at various coal operations were reported as follows in March:

FEDERAL COAL & COKE CO., Grant Town, W. Va.; contract closed with the McNally-Pittsburg Mfg. Corporation for revising present preparation facilities to provide for breaking lump down to minus 4-in. sizes with Norton vertical pick breaker, screening resultant into two sizes and delivering to present preparation equipment; capacity, 150 tons per hour.

NEW BYRNE COAL CO., Byrne No. 1 mine, Fairmont, W. Va.; preparation improvements increasing capacity of plant from 500 to 1,000 tons per day completed, including installation of crusher, additional shaker screens, feeder, picking tables and loading booms.

WARNER COLLIERIES CO., Tiltonville, Ohio; contract closed with the Morrow Mfg. Co. for reciprocating plate feeder, three-track shaker screens, rescreen conveyor and two loading booms for installation at the Russell mine; capacity, 125 tons per hour.

WASSON COAL CO., Mine No. 2, Carrier Mills, Ill.; contract closed with the Morrow Mfg. Co. for replacing equipment, structure and housing recently destroyed by fire.

WINDING GULF COLLIERIES CO., No. 2 mine, Winding Gulf, W. Va.; contract closed with the Kanawha Mfg. Co. for new wood tipple complete with reciprocating feeder; shaker screens; loading booms; mixing, rescreen, slack and refuse conveyors; and auxiliary equipment to prepare six sizes of coal; capacity, 200 tons per hour.

Safety Awards Made

Twelve individual awards and 60 certificates of honor to employees and mining and mineral industry plants were awarded by the Joseph A. Holmes Safety Association at the annual meeting held in Washington, D. C., in March. A gold medal was awarded to an employee of the Littleton Valley Coal Co. for heroic conduct in rescue work, and silver medals were awarded to seven employees of the Union Pacific Coal Co. Certificates of honor were bestowed on coal-mining operations as follows:

Flat Creek (Ala.) division, Alabama By-Products Corporation; Crane Creek mine, American Coal Co. of Allegany County, McComas, W. Va.; Zeigler (Ill.) No. 1 mine, Bell & Zoller Coal & Mining Co.; Bethlehem Mines Corporation, Johnstown, Pa.; Wildwood (Pa.) mine, Butler Consolidated Coal Co.; Somerset (Colo.) mine, Calumet Fuel Co.; Clearfield Bituminous Coal Corporation, Indiana, Pa.; coal-mining department, Colorado Fuel & Iron Co., Pueblo, Colo.; Darby Coal Co., Evarts, Ky.;

Alloy (W. Va.) mine, Electro-Metallurgical Co.; Ellsworth Collieries Co., Ellsworth, Pa.; Hanna Coal Co., St. Clairsville, Ohio; Harlan-Wallins Coal Corporation, Verda, Ky.; Lawrence colliery, Harleigh-Brookwood Coal Co., Mahanoy, Pa.; No. 20 mine, Jamison Coal & Coke Co., Pleasant Unity, Pa.; Lincoln Gas Coal Co., Washington, Pa.; No. 1 mine, Linton-Summit Coal Co., Linton, Ind.; Mary Helen Coal Corporation, Coalgood, Ky.; Morea (Pa.) colliery, Mill Creek Coal Co.; National No. 1 mine, National Mining Co., Bridgeville, Pa.; haulage and tipple forces, Nellis (W. Va.) mine, Nellis Coal Corporation; Vulcan (W. Va.) colliery Norfolk & Western Ry. fuel department;

Monitor stripping, Philadelphia & Reading Coal & Iron Co., Mt. Carmel, Pa.; Pine Hill Coal Co., Minersville, Pa.; Parrish (Ala.) mine, Railway Fuel Co.; St. Clair Coal Co., St. Clair, Pa.; Scranton Coal Co., Scranton, Pa.; Sheridan-Wyoming Coal Co., Monarch, Wyo.; byproduct plant, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.; South Union mine, South Union Coal Co., Uniontown, Pa.; Arno colliery, Stonega coke works, Stonega mine, Stonega Coke & Coal Co., Big Stone Gap, Va.; No. 1, No. 4 and "B" mines, Union Pacific Coal Co., Rock Springs, Wyo.; King No. 2 mine, United States Fuel Co., Mohrland, Utah; Nos. 4 and 6 mines, Vesta Coal Co., California and Denbo, Pa.

Plan 8,209-Mile Gas Line

Natural Gas Service Corporation, Jackson, Miss., has applied for federal funds to finance the construction of 8,209 miles of natural-gas line to serve a population of at least 1,500,000 in central Mississippi and adjoining States, it was reported last month. Cost of the project is said to be $144,000,000, to be covered by a PWA loan.

Inspectors Choose Louisville

Latest developments in safety and rescue work will feature the 25th annual meeting of the Mine Inspectors' Institute of America, to be held at Louisville, Ky., May 7-9. J. T. Ryan, vice-president, Mine Safety Appliances Co., heads the program committee. P. J. Friel, mine inspector, Twenty-fifth Pennsylvania anthracite district, is president.

Soft Coal Continues War On Substitutes

With a five-point program offered by the National Coal Association as guide, bituminous operators, with the cooperation of the miners, continued their war on substitutes in March. Administration support for the program of the industry was demanded by C. B. Huntress, executive secretary, National Coal Association, in a statement on March 12, in which he pointed out that if coal is to continue to bear the increased cost of code operation the government must (1) grant the natural-gas tax promised by the NRA; (2) cease discriminating against coal in favor of laborless oil; (3) stop the diversion of funds to the development of surplus and expensive hydro-electric capacity; (4) set up a fuel and energy coordinating board, as promised by the NRA; and (5) expedite passage of the Thomason bill to protect industries operating under codes from losses on existing government contracts. The association late in March addressed a protest against the proposed enlargement of the TVA power program to Budget Director Douglas, whose department must pass on the request for the additional funds required.

Developments in the campaign against natural gas included submission of a brief in behalf of an excise tax on this product to the division of economic research and planning of the NRA by Charles O'Neill, chairman, government relations committee, National Coal Association, and John L. Lewis, president, United Mine Workers, on March 13. What stand the NRA would take was not announced during the month.

Additional protests against the government's program of developing competitive sources of energy were filed by Hocking Coals, Inc., Southern Subdivisional Code Authority No. 2 of Division I, and the Southern Tennessee Coal Producers' Association. The latter two protested primarily against the Missouri Valley project, while Hocking Coals, Inc., objected not only to this but to the TVA and Arkansas River projects and the St. Lawrence Seaway, which was defeated in the Senate on March 14. Close on the heels of the treaty action, however, came an announcement from Secretary of the Interior Ickes that the Grand Coulee power project on the Columbia River in Washington would be built by the Bureau of Reclamation and operated by the federal government. PWA originally had approved Grand Coulee as a project of the State of Washington, which failed to go through with the contract. Plans call for a 700,000-hp. plant and an annual production of primary and secondary energy of 2,200,000,000 and 500,000,000 kw.-hr., respectively. Total cost is estimated at $62,199,196.

Hours Reduction and Wage Increases Proposed at Code Conference

WASHINGTON, D. C., March 30—After four days of shadow boxing while awaiting the announcement of a new Appalachian wage agreement which was signed early this morning (see p. 152), the bituminous coal code conference reassembled here this afternoon to hear leaders in the northern Appalachian fields propose amendments establishing a 35-hour week as the maximum for the industry. This same group also recommended that Schedule A of the code be amended increasing the base minimum day rates in all fields outside of Division II and parts of Division V. In those divisions, of course, establishment of a 7-hour day without change from the present rates for 8 hours would mean an increase of over 14 per cent in the hourly rates.

The new minimum rates proposed for inside skilled labor under Schedule A of the code (see *Coal Age*, Vol. 38, p. 353) would be $5 per 7-hour day in the Northern fields and $4.60 in the southern districts of Division I, with the $4.60 base also applying to western Kentucky. Under this resolution, the minimum in the Southwest would be raised from $3.75 for 8 hours to $4.60 for 7 hours; in Division III, from $3.40 and $3.84 for 8 hours to $4.60 for 7 hours, with New Mexico and southern Colorado boosted to $5.10 and northern Colorado to $5.25 for 7 hours.

These proposals provoked a storm of protest from spokesmen for Alabama, southern Tennessee, Illinois, Indiana, Iowa, western Kentucky and the Southwest, who complained that they had had no opportunity to see the new Appalachian agreement or to study the proposals made this afternoon. Smokeless operators and northern West Virginia also joined in the protest, which was still being debated when the meeting was adjourned until tomorrow morning.

Until the session held this afternoon, the conference had lived up to NRA traditions of delay when dealing with bituminous coal. Set for Jan. 5 in the code and five times postponed, conferees gathered at the Washington Hotel on the morning of March 26 were greeted with a notice that the meeting would not convene until that afternoon. The first session, presided over by Division Administrator K. M. Simpson, started off with an unsuccessful attempt by John L. Lewis, president, United Mine Workers, to force Illinois operators to declare their position on a shorter work-day. Although Illinois producers had filed a brief in opposition to any change from the 8-hour basis, they declined to be provoked into a public declaration and reserved the right to be heard later if the question should be formally placed before the conference.

William Taylor, executive vice-president, Valley Camp Coal Co., speaking, he said, for the Valley Camp interests and the subdivisional code authority for the northern West Virginia Panhandle, followed with a declaration in favor of the 30-hour week. Under the code, his company had been able to load as much or more coal in 8 hours as in 10 to 14 hours under the "clean-up" system, through better management and increased underground transportation facilities. He also advocated effective correlation of intradivisional code prices and proposed to amend the code to empower the Bureau of Mines to fix monthly maximum allocations of tonnage and hours of work. Prices, he suggested, should be fixed for the same period as wages, and changes in prices should be permitted only after appeal and review.

The western Kentucky subdivisional code authority, declared J. Van Norman, did not believe a shorter work-day was practical. Such a change would not help employment, since it was not feasible to double-shift, but would only reduce earnings. If western Kentucky is to survive, he continued, its present wage differential of 20 per cent under Illinois must be widened another 20 per cent.

W. Z. Price

Technical Adviser on Coal for the National Recovery Administration and largely responsible for the engineers' report on the practicability and cost of a shorter workday and work-week in the bituminous industry, was graduated from Lehigh in 1910 and has since been associated with both anthracite and bituminous mines in engineering, operating and executive capacities. Mr. Price, who succeeded Frank Haas, consulting engineer, in February, conducted the field work in Division V for the engineers' report and was responsible for the editing and assembly of the material and the compilation of the data included in the final draft.

Eugene McAuliffe, president, Union Pacific Coal Co., took issue with Mr. Taylor on the shorter week and with Mr. Norman on lower wages. The Rocky Mountain region leads in high wages and has no desire to abandon that leadership. This region is willing to go along with the rest of the country on any change in hours, but it must consider the consumer who will be driven to other fuels by high coal prices. To increase costs would mean a waste of capital and labor with lessened opportunities for employment. He urged that NRA continue compilation of the *A-B-C-D* reports.

Enthusiasm for these reports also was voiced by H. C. Marchant, chairman, Division V code authority, who indorsed the statements of Mr. McAuliffe on the labor situation. The code is working well in the Rocky Mountain area, but stricter enforcement against non-observers is needed. Emphasizing the seasonal character of the industry and the fact that lignite must move promptly from mine to consumer to avoid degradation, Stanley B. Houck, spokesman for the North Dakota operators, declared that there had been no employment problem in that State prior to the code. Now, inability to work over 40 hours per week in periods of peak demand, which last only a few days at a time, has created a labor shortage and deprived workers of the opportunity to maintain earnings. Alvin D. Clark, vice-president, Covington Coal Co., said that the Southwest also wanted a flexible work-week to take care of seasonal fluctuations.

Following adjournment of the afternoon session, the operators caucused at a meeting presided over by George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co. As a result of this meeting, which reconvened March 27, a committee headed by Mr. McAuliffe waited upon Mr. Simpson and his associates to direct their attention to the fact that Sec. (g), Art. V, of the code laid a mandate upon NRA to present a report on the practicability of changing hours, rates or differentials and other questions of code provisions and administration.

Pressed for a specific answer at the close of the second session of the coal conference on March 28, Deputy Administrator Wayne Ellis replied that NRA was in no position to make any definite recommendations at this time. The administration felt, he said, that the reports it had prepared through its statistical section were about the best it could offer as a guide for the deliberations of the conference. Because of the short period of time (one month) covered by these reports, however, NRA was not prepared to present any views of its own on what should be done.

This second session was featured by a parade of district union officials attacking existing wage differentials. The $3.75 scale in the Southwest was the principal target, although Alabama, western Kentucky and Michigan did not escape. The Southwestern scale, said David Fowler, speaking for Districts 14, 21 and 25, had been established three years ago to help the operators regain lost markets; prior to that time, under union contracts, the day scale had been the same as in Illinois and Indiana. The union now asks for a $4.60 base. Mr. Fowler called attention to the hundreds of small mines in Missouri, paying, he said, from nothing to 15c. per hour. He also asked for a limitation on machine hours.

Frank Wilson, president, District 13, declared Iowa was threatened by lower wages in the Southwest and western Kentucky and asked that these be raised to a Division II basis. Increase of the Southwestern rate to $4.70 was advocated by Frank Hefferly, District 15

(Colorado and New Mexico). Western Kentucky rates should be increased to $4.60, asserted E. J. Morgan, District 23, who thought it unfair to make the worker bear the cost of adverse freight differentials. Central Illinois, he remarked, pays less freight northbound than southern Illinois, but workers in the latter field are not expected to absorb the difference in lower wages. Reductions in wages in Vanderburg and Warrick counties, Indiana, were scored by James J. Timko, president, District 11, who also argued for shorter hours and higher minimum rates of pay. William Turnblazer, president, District 19, wanted Alabama and southern Tennessee wage rates raised to the Appalachian levels. Michigan miners, said Robert Scott, District 24, should have their minimum restored to the Illinois-Indiana level.

Speaking for the Northern Colorado Coal Producers' Association, Miss Josephine Roche, president, Rocky Mountain Fuel Co., agreed with Mr. Hefferly that the Southwestern differential was unfair. She also would eliminate the differential between northern and southern Colorado, but was not prepared to go along personally with the conclusion that, until these scales were equalized and competitive fuels controlled, increases in wages and reduction in hours would hurt. Warren Pippin, spokesman for the Michigan operators, stressed the seasonal character of Michigan production, but said his State was ready to follow the dictates of the government and the majortiy of the industry in any changes. He insisted, however, that higher wages meant higher costs and less employment. Mr. Marchant voiced the belief that the differential adjustment between the Southwest and New Mexico-Colorado was unfair to the latter States.

Defense of the Alabama wage structure was offered by Darius A. Thomas, chairman, Division III code authority. The competitive situation confronting that State had been recognized in the negotiation of the wage agreement with the union which became effective March 16 and continues until next April. Is this settlement of a dispute which involved approximately 10,000 men on strike, he asked, to be merely a three-weeks' agreement?

The meeting today was the third session of the conference and had been postponed first from Thursday to this morning and then to this afternoon. Some observers attributed these delays and the inconclusive character of the two preceding sessions on Monday and Wednesday to a repetition of the administration strategy for wearing down resistance which was so much in evidence last summer during the original code negotiations. At that time it was used effectively to induce non-union operators to enter into contractual relations with the United Mine Workers. Today, it appears to be directed primarily against operators in fields where contracts embodying the eight-hour day extend beyond April 1, many of whom did not realize the seriousness of the drive for shorter hours until they reached Washington. These operators, from the Middle West and producing areas west of the Mississippi, were invited to meet with smokeless operators on Thursday to discuss the situation. Despite unexpired contracts and the higher costs of the shorter work-day shown in the report of the mining engineers appointed by the NRA to investigate the question, summarized on p. 141 of this issue, many Western operators are privately convinced from their canvass of Washington and union sentiment that their opposition will be hopeless.

While moratoriums on contracting were being declared by subdivisional code authorities in Divisions I, II and IV, operators in Division I continued work on machinery for settling price disputes between subdivisions. The principal move was a recommendation that subdivisional authorities (except western Kentucky, which would not be subject to its jurisdiction) approve the establishment of a "Board of Review" composed of disinterested persons to hear and decide appeals.

Eastern railroads resumed their drive for concessions on fuel purchases last month. With C. D. Young, Pennsylvania R.R., and Charles O'Neill, vice-president, Peale, Peacock & Kerr, Inc., as spokesmen for the respective interests, negotiations again got under way in Washington on March 16, and committees were appointed by the carriers and operators to continue the discussions. Operators and the districts they represent are: northern West Virginia Panhandle—R. J. Cotts and M. F. McQuade; western Pennsylvania (any two to serve)—George H. Love, H. L. Findlay and Walter Sheppard; central Pennsylvania—Charles O'Neill and C. E. Crafts (L. G. Ball and C. A. Owen, alternates); northern West Virginia (any two to serve)—R. M. Hite, W. D. Barrington and A. Lisle White; Ohio (any two to serve)—R. L. Ireland, Jr., W. L. Robison, William Emery, Jr., and George K. Smith; southern low-volatile—W. A. Richards and W. G. Crichton; southern high-volatile—J. D. Francis and J. M. Vest. Negotiations were adjourned on March 24 pending outcome of the Appalachian wage discussions and the code conference.

Two subdivisional code authority elections were held in March. Fourteen members of the Southern Subdivision No. 1 (low-volatile) code authority were reelected at a meeting at White Sulphur Springs, W. Va., March 12, and a new member was added, as follows: P. M. Snyder, C.C.B. Smokeless Coal Co.; A. A. Liggett, Raleigh Coal & Coke Co.; O. L. Alexander, Pocahontas Fuel Co., Inc.; Edward C. Page, Crozer Coal & Coke Co.; W. A. Richards, Majestic Collieries Co.; H. B. Baird, Berwind-White Coal Mining Co.; William G. Caperton, Slab Fork Coal Co.; W. G. Crichton, Johnstown Coal & Coke Co.; T. B. Davis, Island Creek Coal Co.; O. M. Deyerle, Flat Top Fuel Co.; H. D. Everett, Smokeless Coal Co.; S. S. Nicholls, White Oak Coal Co.; George W. St. Clair, Jewell Ridge Coal Corporation; J. L. Steinbugler, W. C. Atwater & Co., Inc.; James W. Carter, Carter Coal Co. (new member).

The following were chosen members of the Illinois subdivisional code authority for the coming year on March 13: northern Illinois—T. C. Mullins, Northern Illinois Coal Corporation; central Illinois—George W. Reed, Peabody Coal Co.; A. L. Wilcoxson, Sangamon Coal Co.; G. D. Cowin, Bell & Zoller Coal & Mining Co.; A. B. Steffens, Indiana & Illinois Coal Corporation; and C. J. Sandoe, West Virginia Coal Co. of Missouri; Belleville—H. E. Howard, Binkley Coal Co., and W. F. Davis, St. Louis & O'Fallon Coal Co.; southern Illinois—D. W. Buchanan, Old Ben Coal Corporation; George B. Harrington, Chicago, Wilmington & Franklin Coal Co.; W. J. Jenkins, Consolidated Coal Co. of St. Louis; and F. H. Woods, Sahara Coal Co.; L. C. L. operators—Frank Ade, Prairie Coal Co.

Utah was given permission to establish a subdivisional code authority in March.

Plans for a vigorous drive against bituminous code violators in the northern Colorado and southern Colorado-New Mexico subdivisions of Division V were laid at a meeting in Denver, March 5, attended by H. C. Marchant, chairman, and John R. Doolin, secretary, Division V code authority; N. C. Brooks and George P. White, secretaries of the respective subdivisional authorities; U. S. District Attorney Thomas J. Morrissey; and Norris C. Bakke, of the Colorado Attorney General's staff. Enforcement in Colorado will be carried out by both federal and State authorities, it was declared, the latter acting under the new State recovery act. Federal authorities will push prosecution of interstate violators, and it was announced that an indictment against one large Colorado operator doing an interstate business would be asked at the next session of the federal grand jury.

Dock Code Signed

Completing the line-up of solid-fuel distribution codes, General Johnson, NRA Administrator, signed the dock code on March 16.

General Johnson also approved the industry members of the Code Authority for the Wholesale Coal Industry on March 24, as follows: C. S. B. Ward, Wieman & Ward, Pittsburgh, Pa.; W. H. Carpenter, Dexter-Carpenter Coal Co., New York; A. D. Carlton, Cleveland Cliffs Iron Co., Cleveland, Ohio; G. E. Copeland, C. W. Claflin Co., Boston, Mass.; C. W. Hendley, C. W. Hendley & Co., Inc., Baltimore, Md.; J. N. McCabe, Gruschow-McCabe Coal Co., Chicago; and H. D. Wright, Republic Coal & Coke Co., Chicago. Arthur Hale, commissioner, American Wholesale Coal Association, Washington, D. C., has been named secretary.

Completing the Code Authority for the Retail Solid Fuel Industry, General Johnson on March 12 announced the appointment of two additional members not associated with the National Retail Coal Merchants' Association, as follows: John McLachlan, Pullman, Ill., equipped independent retailers, and Edward B. Jacobs, Reading, Pa., unequipped independents. Other members are: Roderick Stephens, Stephens Fuel Co., New York (chairman); Milton N. Robinson, Jr., Chicago; William A. Clark, Boston; Clarence V. Beck, St. Louis, Mo.; and Proctor L. Daugherty, Washington (administration member).

Appalachian Agreement Sets 35-Hour Week With Substantial Wage Increases

WASHINGTON, March 30—Including a seven-hour day and substantial increases in hourly and piece-work rates, a new wage agreement covering the Appalachian region with the exception of the smokeless, southern Appalachian and northern West Virginia fields was signed this morning. Smokeless producers, who elected to negotiate separately from the start, continued conversations with the miners' representatives in an attempt to iron out difficulties before April 1. Northern West Virginia withdrew as a result of the elimination of the differential under Pittsburgh and other Northern mines which it enjoyed under the old agreement, and announced that it would appeal to the NRA for an impartial board to adjudicate the question.

Signing of the new contract climaxed more than a month of negotiations, which started off with the miners and operators diametrically opposed on the request of the United Mine Workers for a wage increase, a six-hour day and a 30-hour week, and worked down through a series of negotiating committees until concessions by both sides resulted in agreement on a seven-hour day, a 35-hour week, basic scales of $5 a day for Northern mines and $4.60 for Southern mines, increases of 8c. per ton in loading scales and 1c. per ton in cutting scales and a 9-per cent boost in yardage and deadwork rates. The basic rate in the old agreement was $4.60 for eight hours at Northern mines, $4.36 for northern West Virginia and $4.20 for Southern mines.

Evolution of the negotiations finally placed the burden on the shoulders of a joint committee of four miners and four operators. John L. Lewis, president; and Philip Murray, vice-president, together with Percy Tetlow, president, District 6, and Van A. Bittner, president, District 17, represented the United Mine Workers. The operators were represented by the "Four Horsemen" of the code campaign—J. D. A. Morrow, president, Pittsburgh Coal Co.; Charles O'Neill, vice-president, Peale, Peacock & Kerr, Inc.; J. D. Francis, vice-president, Island Creek Coal Co.; and Ralph E. Taggart, vice-president, Stonega Coke & Coal Co.

Ending a strike which began on Feb. 19 and involved over 40 mines and 10,000 men at its height, according to reports, Alabama operators representing 80 per cent of the commercial tonnage of the State, on March 16, signed a wage contract patterned after the Frick agreement in that while officials of the United Mine Workers were parties to the contract they participated not in an official capacity but as representatives of the miners. Consummation of the agreement followed intervention by State officials after National Guard troops had been called out and the Division III Labor Board, by a 2-to-1 vote, had held the walkout to be a violation of the bituminous code, accompanying its decision with an order to return to work on March 12.

Sec. 4 of the agreement, effective for one year from April 1, provides for checking off dues, assessments and initiation fees when authorized by the international executive board of the union and includes a clause to the effect that operators will be protected against loss by District 20. Sec. 5 provides for the election of checkweighmen, and Sec. 7 for the selection of pit committees. Wage rates are shown in the accompanying tables.

Commercial operators not participating included the DeBardeleben Coal Corporation, which announced on March 26 that it had obtained an injunction to restrain the United Mine Workers from interfering with, intimidating or coercing its employees, offering as grounds armed invasion of homes in Coal Valley. Of the Alabama captive operations, the Woodward Iron Co., Tennessee Coal, Iron & R.R. Co., and Republic Steel Corporation granted a voluntary check-off early in the month.

The Progressive Miners of America received still another setback in their campaign for control of Illinois miners when the National Labor Board announced on March 8 that it "did not feel justified in taking up the appeal for a review or in ordering a referendum" in view of the unanimous rejection of the Progressive request by the Division II and National bituminous coal labor boards.*

Balked in this direction, the Progressives planned a series of mass meetings to drum up support for a state-wide vote, and on March 10 started injunction proceedings in the U. S. District Court, East St. Louis, to restrain the Peabody Coal Co. and the United Mine Workers from "violating the NRA and the bituminous coal code" at Mines 43, Harrisburg, and 47, Harco, where UMW contracts had previously been upheld. Members of the insurgent union formerly employed at the two mines also applied for an injunction to preserve their "right of collective bargaining." After arguments on March 17, U. S. District Judge Fred L. Wham continued the case to allow both sides to file briefs.

Illinois legislators also took a hand in the controversy last month, the House of Representatives adopting on March 21 a resolution requesting both President Roosevelt and Governor Horner to support a state-wide referendum.

Another in the series of strikes over distribution of work between the collieries of the Lehigh Navigation Coal Co. in the Panther Creek Valley anthracite field came to an end on March 12 when approximately 8,000 men returned to work. The stoppage began on March 5 after the miners had rejected a proposal that employees at the Rahn colliery, idle since April, 1931, be employed on the second shift at other operations, demanding instead that Rahn be reopened in spite of the company's declaration that the necessary clean-up

*Through error, it was stated in the March *Coal Age*, p. 115, that the National Labor Board had passed on the Progressive appeal from the Division II ruling, and that John M. Carmody had been elected its chairman. The National Bituminous Coal Labor Board was meant in both instances.

Hourly Rates for Inside Day Labor Included in Alabama Agreement*

Classification	Cents
Firebosses	52½
Electricians	51½
Machine runners	50½
Face bosses, section men, wall bosses	49½
Weighmen	46½
Coal drillers, shooters	44¼
Bonders, bratticemen, miners taken from face, rockmen, shift leaders, timbermen, trackmen, wiremen	42½*
Motormen	41¼
Scrapers, cutting machines	40¼
Loaders (mechanical units), electricians' and machinists' helpers	39¼
Drivers, spike teams	38¼
Car trimmers, chainers, check pullers, couplers, drivers (single), greasers, hoist engineers, laborers and helpers, loaders (unskilled), muckers, pumpers, rock-dusters, rollermen, substation attendants, trappers, tripriders, yardmen and bond, brattice, rock, timber, track and wire helpers	36½

*Where higher rates already are being paid, they shall be continued. Basic rate of 42½c. corresponds to that established in the bituminous code.

Hourly Rates for Outside Day Labor Included in Alabama Agreement*

Classification	Cents
Armature winders, electricians, machinists	50
Blacksmiths	47
Main hoisting engineers, day	45
Night	40
Washermen	45
Linemen	41½
Weighmen	41
Carpenters	40
Car repairers	38
Refuse engineers	35
Lampmen, day	35
Night	30
Chainers, couplers, dumpers (coal or rock), fanmen, greasers, loaders (railroad-car), sand dryers, scalers, spraggers, tipplemen, watchmen, washer labor and blacksmiths', carpenters', electricians', machinists', and washermen's helpers	30
Slate pickers	25

*Where higher rates already are being paid, they shall be continued. Basic rate of 30c. corresponds to that established in the bituminous code.

Tonnage, Yardage and Deadwork Scales Established in Alabama Agreement*

Machine-Cut Coal	Thickness of Seam: Under 26 In., Cents	26-32 In., Cents	32-48 In., Cents	Over 48 In., Cents
Drilling, shooting, loading, track, timbering, tramming, furnishing tools and explosives, per ton	63	57½	52	46
Same, company shooting and explosives	57½	52	46	40
Loading and tramming, per ton	46	40	37½	34½
Cutting, per ton	10	9	7½	5

Pick Mining — Cutting, Drilling, Shooting, Loading, Track, Timbering, Tramming, Furnishing Explosives	
Coal under 26 in., per ton	$0.92
26 to 32 in.	0.77½
32 to 48 in.	0.72
4 to 6 ft.	0.66
6 to 8 ft.	0.57½
Over 8 ft.	0.55
Pillar coal, over 6 ft., no explosives required	0.52
4 to 6 ft.	0.57½
Yardage	
Entry brushing (per 12 in. of thickness):	
Slate up to 2½ ft., 9 ft. wide, per yd.	$0.80
Slate and rock up to 2½ ft., 9 ft. wide, per yd.	0.85
Sand rock up to 2½ ft., 9 ft. wide, per yd.	0.95
Bottom leveling up to 2½ ft., 9 ft. wide, per yd	0.85
Aircourses, crosscuts, entry breakthroughs, rockeyes, under 12 ft. wide in 32- to 48-in. coal, per yd.	0.52
Room brushing:	
Per in. per yd.	0.02
Room turning:	
Under 9-ft. neck, less than 12 ft. deep, each	1.50

*Where higher rates are being paid, they shall be continued. Rates of pay to be adjusted to insure piece workers the customary differentials in earnings per pay over day workers.

activities would rob the plan of any value through delay. The strike was opposed by John L. Lewis, president, United Mine Workers, who ordered the men back on March 8 and appointed a commission to inquire into the strike and also investigate discipline within the union organization. On March 14, after union representatives and company officials had met with the commission, it was announced that steps would be taken to provide work for men now idle.

With March 15 set as the deadline for submission of grievances by the United Anthracite Miners of Pennsylvania to James A. Gorman, conciliator, and the Anthracite Conciliation Board, previously delegated by the National Labor Board to investigate the charges of the new union, the insurgents announced plans to extend their organization to the middle and southern anthracite fields (Districts 7 and 9).

Cincinnati Convention Program Covers Many Subjects

More than 50 addresses and papers covering the economic, management, operating and safety problems of the coal-mining industry have been scheduled for presentation at the Eleventh Annual Convention of Practical Coal-Operating men, to be held in conjunction with the National Exposition of Coal-Mining Equipment at the Music Hall, Cincinnati, Ohio, May 7-11, under the auspices of the Manufacturers' Section of the American Mining Congress. Subjects included in the preliminary program are as follows (speakers are yet to be announced in some cases):

Monday — "The Industry From the Practical Operating Standpoint," by C. M. Lingle, vice-president, Buckeye Coal Co., and national chairman, program committee; "Facing the Future With the Coal Industry," by R. L. Ireland, Jr., vice-president, Hanna Coal Co., and chairman, Coal Division, American Mining Congress; "How the Manufacturers Are Aiding the Coal Industry in Solving Its Problems," by J. T. Ryan, vice-president, Mine Safety Appliances Co., and chairman, Manufacturers' Section; "Codes and Natural-Resource Industries"; "Competitive Fuels"; "Review of Mechanical Loading," by G. B. Southward, mining engineer, American Mining Congress; "Review of Newest Things in the Equipment Field"; "Comparative Results in Wet and Dry Washing," by T. W. Guy, consulting engineer, Charleston, W. Va.; "Efficiencies of Concentrated Mining," by J. D. Rogers, Stonega Coke & Coal Co., with discussion by I. N. Bayless, Union Pacific Coal Co.; "Promotion of Safety Educational Work Through Safety Meetings," by E. B. Agee, Youngstown Mines Corporation, with discussion by F. S. Lenhart, W. J. Rainey, Inc.

Tuesday—"Scouring Device for Removing Stains and Restoring Original Luster to Coal," by T. M. Dodson, Weston Dodson & Co., Inc.; "Mining With the Coal Saw"; "Air Cleaning Bituminous Coal," by L. N. Thomas, Carbon Fuel Co.; "Constructive Safety work," by E. L. Berger, Bell & Zoller Coal & Mining Co.; "Shorter Work-Week and Accelerated Mechanization," by George C. McFadden, Peabody Coal Co.; "Use of Gunite as a Means of Roof Control"; "Haulage System With Permissible Battery Locomotives"; "Mechanical Loading of Slate in Entries and Aircourses"; "Efficient Use of Electrical Power," by M. W. Horgan, Monongahela West Penn Public Service Co.; "Drilling at the Enos Coal Mining Co.," by C. R. Barnard, chief engineer, with discussion by J. B. F. Melville, Electric Shovel Coal Corporation; "Safety in the New River District," by Charles E. Vawter, Gauley Mountain Coal Co.; "Development of Wood Preservation"; "Effect of Price Regulation on Mechanical Cleaning of Coal."

Wednesday—"Maintenance of Electrical Equipment From the Safety Inspector's Viewpoint"; "Underground Distribution of Power," by K. L. Konnerth, H. C. Frick Coke Co., with discussion by W. P. Vance, Butler Consolidated Coal Co.; "Multiple Shifting"; "Wet Cleaning of Small Sizes," by B. C. Osler, Pardee Bros. & Co.; "Mechanically Welded Fastenings on Underground Coal Conveyors"; "Practical Operation of the Wuensch Coal-Cleaning System"; "Methods of Mining 33- to 41-In. Coal"; "Coal Sampling"; "Cleaning at the No. 4 Plant of the Pond Creek Pocahontas Co.," by F. C. Carothers, superintendent; "History of Shooting During the Shift"; "Protective Clothing and Safety," by Clyde G. Brehm, Susquehanna Collieries Co.; "Use of Track-Mounted Cutting Machines."

Thursday—"Air Shooting—An Entirely New Process," by C. J. Sandoe, West Virginia Coal Co. of Missouri; "The Energy Air Miner," by Fred A. Miller, Franklin County Coal Co.; "Cleaning Plant of the Binkley Coal Co.," by Walter E. Rutledge, vice-president; "Solving Ventilation Problems"; "Progress of Mechanical Methods of Production"; "Efficient Haulage Systems," by E. H. Jenks, Rochester & Pittsburgh Coal Co.; "Systems Best Adapted to Mechanical Mining"; "Latest Practice and Results in Dedusting"; "Effect of the Coal Code on Safety and Discipline"; "Shaker Conveyors and Their Adaptation to a 22-Deg. Pitch," by P. H. Burnell, Owl Creek Coal Co.; "Accident Prevention."

Friday—"Costs as Related to Mining," by Carol Robinson, Kellys Creek Colliery Co.; "Gathering Locomotive Haulage"; "Problems of the Stripper," by D. R. Swem, Northwestern Improvement Co.; "The Mining-Company Town—Government, Sanitation, Social Outlook and the Ideal It Should Represent"; "Drainage Problems"; "Screening Practice"; "Research Work Along Utilization Lines," by T. H. Kerr, Lorain Coal & Dock Co.; "The Effect of Sealing Mines on River Water"; "Promoting Safety as a Sound Investment," by J. F. Bryson, Harlan County Coal Operators' Association; "Achieving Safety Through Safety Meetings"; "Use of Steam Hoists."

Permissible Plates Issued

Six approvals of permissible equipment were issued by the U. S. Bureau of Mines in January and February, as follows:

(1) Sullivan Machinery Co., Type RHE-5 room hoist; 5-hp. motor, 230 volts, d.c.; Approval 263; Jan. 11.

(2) Deming Co., "Oil-Rite" mine pump; 5-hp. motor, 250 and 500 volts, d.c.; Approvals 264 and 264A; Jan. 31.

(3) Jeffrey Mfg. Co., Type 61 HG face conveyor; 2-hp. motor, 230 volts, d.c.; Approval 219; Feb. 6.

(4) Jeffrey Mfg. Co., Type 61 AM conveyor; 10-hp. motor, 230 volts, d.c.; Approval 265; Feb. 12.

(5) Brown-Fayro Co.; Brownie Model HG room hoist; 5-hp. motor, 500 volts, d.c.; Approval 169A; Feb. 26.

(6) Brown-Fayro Co.; Brownie Models HIc and HKc car spotters; 5-hp. motor, 500 volts, d.c.; Approval 266A; Feb. 27.

Push Labor Bills

Legislative efforts in behalf of labor proceeded on two major fronts in Washington last month. The House Labor Committee on March 6 reported out the Connery bill providing for a 30-hour week in all industries covered by codes, continuation of present wage scales, establishment of a board to allow exemptions (not exceeding 40 hours per week) from the hours restrictions in case of emergency or labor shortage for a period of three months, and equal labor representation on code authorities.

Hearings on the Wagner bill "to equalize the bargaining power of employers and employees, to encourage the amicable settlement of disputes between employers and employees, to create a National Labor Board and for other purposes," began before the Senate Committee on Education and Labor on March 14. Employer groups and trade organizations, almost without exception, aligned themselves against the measure, which, in addition to providing for the creation of a permanent National Labor Board and the establishment of a U. S. Conciliation Service in the Department of Labor, forbids employers interfering with the right of labor to organize and bargain collectively, refusing to recognize or deal with representatives or failing to exert every reasonable effort to make and maintain wage and working agreements, fostering, assisting or influencing any labor organization or indulging in discrimination tending to encourage membership or non-membership in any labor organization. Developments late in March indicated several changes in provisions.

Anthracite Burner Standards

A commercial standard for domestic burners using Pennsylvania anthracite was adopted at a meeting of manufacturers, distributors and purchasers of such equipment in New York in March. The meeting was called by the U. S. Bureau of Standards at the instigation of the Anthracite Institute, and unanimously adopted a code outlining minimum standards of construction, installation and operation based on the approval code of the Anthracite Institute Laboratory.

Robins Acquires Chance Rights

Bituminous sales, engineering and construction rights to the Chance sand-flotation process in the United States and Alaska have been acquired by the Robins Conveying Belt Co., New York, from the T. M. Chance estate. Joseph Pursglove, Jr., consulting engineer, Cleveland, Ohio, and formerly engineer, Powhatan Mining Co., has been appointed consulting engineer for the Chance estate, and will cooperate with the Robins company in securing maximum efficiency from installations, conduct laboratory tests and act in an advisory capacity in the preparation of coal-cleaning recommendations and in the design and construction of plants.

New Kentucky Mine Law

A new State mine law, drawn up by John F. Daniel, chief, Kentucky Department of Mines, and approved by operators and miners, was signed late in March. The new statute, effective July 1, includes the following provisions: application to all commercial coal mines (producing coal for sale or exchange); ventilation by mechanical means at all mines employing more than five men, and by means approved by the department at mines employing less than five men; compulsory employment of a certified mine foreman at all mines employing more than six men; compulsory first-aid training in accordance with the department's recommendations for all mine workers; handling of explosives in all solid-shooting mines to conform to the department's methods and procedure.

Homestead Project for Iowa

Establishment of a subsistence homestead project at Granger, in the central Iowa coal field, was announced by Secretary of the Interior Ickes on March 15. Homesteaders for the most part will be chosen from among the 1,500 miners at the nine mines within a 15-mile radius of the site, and each will be settled on four to five acres of good land with a small but modern house and the necessary outbuildings. Completed homesteads will cost in the neighborhood of $2,000 and will be sold on a long-term basis. Mine operators will cooperate by assuring as far as possible part-time employment for residents.

Plans for subsistence homesteads at Jasper, Ala., and Crossville, Tenn., also were announced in March. Both will draw part of their occupants from unemployed coal miners in their respective districts.

Scrip Committee Named

Pursuant to the provisions of the retail trade, retail jewery and retail food and grocery codes, NRA Administrator Johnson last month named the following to a committee to investigate "the economic and social implications of wage payments by means of company scrip and the receipt of such scrip by retailers in lieu of cash": Dr. Charles Fowler, professor of economics, College of the City of New York (chairman); Daniel Bloomfield, executive secretary, Boston Retail Trade Board; and Dr. Henry Post Dutton, professor of factory management, Northwestern University, and associate editor, *Factory Management and Maintenance*, a McGraw-Hill publication.

Representatives of the anthracite, bituminous, textile and lumber industries met in Washington, D. C., March 23, to prepare plans for submitting data to show that the scrip and extension-of-credit provisions should be eliminated from the codes.

Blank & Stoller

The Late J. A. Donaldson

Personal Notes

CHARLES E. STUART, president, Stuart, James & Cooke, Inc., consulting engineers, New York, has been elected vice-president of the First Export-Import Bank for International Trade.

H. D. JAMES, control expert and long a consulting engineer for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has resigned to enter private practice, with headquarters at Pittsburgh, Pa. Mr. James will specialize in industrial, mining and building problems, with particular attention to purchasing from an engineering standpoint, cost analysis and design of equipment.

Coming Meetings

Mine Inspectors' Institute of America; twenty-fifth annual convention, May 7-9, Brown Hotel, Louisville, Ky.

American Mining Congress; annual convention and exposition, May 7-12, Cincinnati, Ohio.

Illinois Mining Institute; annual boat trip and summer meeting on Str. "Cape Girardeau," leaving St. Louis, Mo., 8 p.m., June 8, and returning June 10.

American Society for Testing Materials; annual meeting, June 25-29, Chalfonte-Haddon Hall, Atlantic City, N. J.

J. A. Donaldson Dies

John A. Donaldson, 69, president of the Joy Mfg. Co., Franklin, Pa., and long connected with the coal industry in western Pennsylvania, died at his home in Ben Avon, Pa., March 4. Born in Canzor, Pa., in 1865, Mr. Donaldson was associated with the Pittsburgh Coal Co. for almost 40 years, 20 of which he spent in Cleveland, Ohio, later moving to Pittsburgh as vice-president and retaining management of operations of the company for eighteen years. He resigned to become president of the Joy company in 1925 as a result of earlier participation in the development of mechanical loading, coupled with an interest in the original Joy patents.

Obituary

GEORGE WADDELL, 54, president of the Waddell Coal Co., Phillipi, W. Va., died at Cumberland, Md., March 19, after a heart attack. Mr. Waddell, who was born at Maryhill, Scotland, was brought to this country when nineteen months old, and first started his mining career at Boswell, Pa. He began operations at Phillipi eighteen years ago.

HENRY WADE, pioneer Utah operator, died at his home in Salt Lake City in March of the infirmities of age. Mr. Wade, who was born in Durham, England, in 1853, took a prominent part in the development of the Kenilworth and Hiawatha mines, now operated by the Independent Coal & Coke and the United States Fuel companies, respectively.

Industrial Notes

WILBUR G. HUDSON has been appointed chief engineer of the Link-Belt Co.'s Pershing Road plant, Chicago. Mr. Hudson first entered the employ of the Link-Belt Co., Philadelphia, as a draftsman, and later was appointed general superintendent of construction. In 1908, he joined the Guarantee Construction Co., New York, specializing in materials-handling work, as vice-president, and later became president of the Wilbur G. Hudson Corporation, specializing in the same type of work.

RALPH G. CAULLEY, formerly with the Wheeling Steel Corporation, has joined the Detroit (Mich.) sales staff of the Republic Steel Corporation.

BABCOCK & WILCOX TUBE CO., New York, has enlarged the territory served by its Tulsa (Okla.) sales office to take in Oklahoma and southern Kansas.

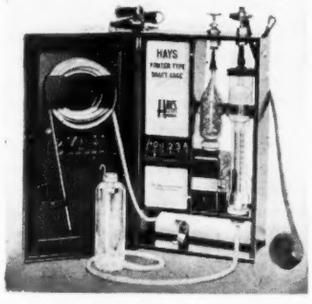
SULLIVAN MACHINERY CO., Chicago, has purchased the assets of Joy Bros., Inc., coal-saw manufacturers, it was announced last month.

HARVEY DIETERICH, manager, structural department, Joseph T. Ryerson & Son, Inc., Chicago, has been made assistant vice-president in charge of the structural and special order departments. AINSLIE Y. SAWYER, cold-finished-steel division, has been appointed assistant general manager of sales, and will specialize in field promotion of Ryerson products.

WHAT'S NEW
IN COAL-MINING EQUIPMENT

Combustion Test Set

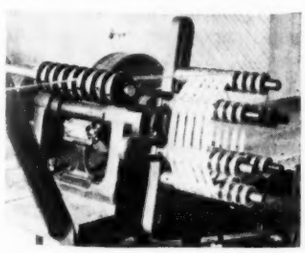
Hays Corporation, Michigan City, Ind., offers the new Series 3000 combustion test set for use by service and testing engineers and consultants. The set combines a CO_2 analyzer and a dry-type pointer gage. A small fountain-pen-type flue-gas thermometer also can be supplied. The equipment is



housed in a light stamped steel case, and the entire unit weighs 9 lb. Convenient reels and clamps for rubber tubing and accessories are included, the company points out, and the carrying handle swings out of the way when unsnapped. A test can be started as soon as the case is opened, it is asserted, and the instrument need not be leveled.

Coil Winder

Ideal Commutator Dresser Co., Sycamore, Ill., offers the "Ideal" coil winder, which, it declares, is adaptable to making almost any type of coil for motors, armatures, fields, transformers, etc., with diamond, round, square or rectangular cores. Having no solid side walls, each layer of field or transformer coils can be laced with tape so that no tying is necessary to keep them from springing apart when the machine is collapsed. Diamond



coils, says the company, are made in series in any number up to eight. Other features cited by the company are: lightness, quick adjustability, low first cost, no wearing parts, form tubes instantly removable from finished coils, and faceplate easily fitted to any lathe head. Base and slide are made of cast steel.

Bronze Valves

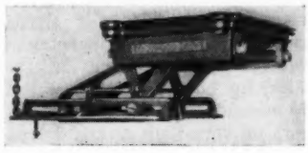
A new line of heavy standard bronze globe and angle valves is offered by the Kennedy Valve Mfg. Co., Elmira, N. Y., which points out the following features: cadmium plating on malleable-iron union bonnet ring and stuffing-box nut; union bonnet-ring construction with malleable-iron ring for strength and rigidity; bronze-to-bronze true union joint between body and bonnet; special bearing surface (stem head with rounded, machined bottom surface making low-friction contact with smooth, milled recess in disk holder)

to reduce operating friction; four guide prongs on disk holder to prevent binding or tipping as the valve is opened or closed and to facilitate clamping holder in vise for replacement of the disk; unusually high raised seat in body to increase the distance which the disk must wear down before the holder strikes the metal; disk holder designed to lock on the stem at a definite position—wide open—to prevent it from falling out, becoming damaged or interfering with assembly (a half turn of the stem releases the holder); adaptability to repacking under pressure; cadmium-plated, malleable-iron packing nut with unusual number of threads to withstand hard usage and add to packing life; special molded self-lubricating packing; and interchangeable parts between globe and angle valves of the same size.

Globe valves are designated as Fig. 89; angle valves as Fig. 90. Both are available in sizes from ¼ to 3 in., inclusive, for 150-lb.-per-square-inch steam and 250-lb.-per-square-inch water pressure.

Drive Bases

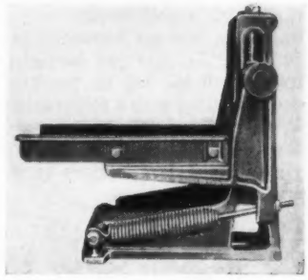
Rockwood Mfg. Co., Indianapolis, Ind., offers two new Rockwood drive bases—ceiling and vertical. The ceiling drive base, according to the company, gives the same full range of tension adjustments available in the floor-



Rockwood Ceiling Drive Base.

mounting bases and, in addition, facilitates adjustments as compared with the usual horizontal drive. Special hanger arms suspend the motor horizontally, giving greater clearance under the ceiling, and the adjustable steel angles which move horizontally on the hanger arms are supported on a ledge cast on the bottom of the hanger arms. This ledge carries the weight of the motor and relieves the screws in the arm slot. It also allows the adjustable angles to be moved along the ledge by secondary-arm screws while the drive is running. A safety chain is provided to prevent the motor from falling below the horizontal position even if the belt or fastener should fail.

In the case of the vertical-drive base, as in all Rockwood drives, according to the company, the motor is mounted on two adjustable horizontal arms suspended from a pivot shaft. But in the

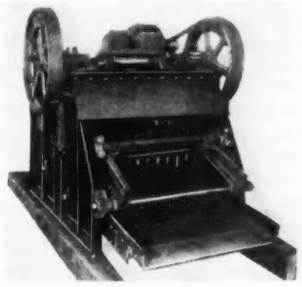


Rockwood Vertical Drive Base.

vertical-drive adaptation, the weight of the motor is counterbalanced by two coil springs connected by rods to the bracket arms. These springs, it is pointed out, are adjustable to supply the required belt tension when the motor is either above or below the driven pulley. Vertical adjustment to provide for belt stretch is accomplished by moving the pivot shaft vertically by means of the adjusting screws. The latter also assist in securing pulley alignment.

Vertical Pick Breaker

McNally-Pittsburg Mfg. Corporation, Chicago and Pittsburg, Kan., has added the Norton Style B vertical pick breaker to its line of preparation equipment. This breaker, like the older Style A breaker (*Coal Age*, February, 1933, p. 73), breaks down large coal by the piercing action of vertical picks. A distinctive feature of the new breaker, according to the company, is the use of a shaker feed instead of the conveyor feed characterizing the Style A equipment. Use of alternate screen plates and dead plates in the shaker-feed mechanism, it is pointed out, allows the fines to drop out immediately

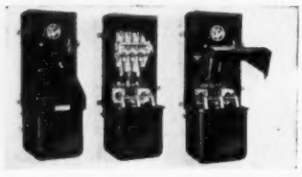


and therefore suffer no further degradation while sizing of the lumps is continued.

As indicative of the results that may be obtained with the vertical pick breaker, the company offers the following results of tests by the Beckley (W. Va.) Testing Laboratory on a soft, friable bituminous coal broken down to a maximum size of 7 in.: ¼x0-in. material, 9 lb. per hundred less than with a roll crusher; 1¼x¼ in., 2¼ lb. less per hundred; 2½x 1¼ in., ¼ lb. less per hundred; total, 2½x0 in., 11¼ lb. per hundred less than with a roll crusher. With coals of firmer structure, according to the company, the yield of the larger sizes is increased.

Magnetic Starter

For motors up to 30 hp., 220 volts; 60 hp., 440 volts; and 75 hp., 550 volts, Electric Controller & Mfg. Co., Cleveland, Ohio, offers the No. 2, Type ZOS, oil-immersed, across-the-line combination starter, a larger companion to the No. 1 type previously announced. Equip-



ment includes an unfused or fusible safety switch and a magnetic starter with overload relays. All internal wiring is complete. While designed for heavy-duty mill service, exceptional smallness and narrowness make installation on machines or in groups easy, according to the company.

Flexible Coupling

Smith & Serrell, Newark, and John Waldron Corporation, New Brunswick, N. J., have developed an all-steel, lubricated, gear-type coupling bearing the designation Waldron "Torque Ring" coupling. According to the makers, heavily loaded bolted and flanged connections have been eliminated and the torque is carried by lubricated surfaces through solid metal parts from hub to hub. End plates serve as a dust- and moisture-proof inclosure, with the center sleeve holding an oil supply sufficient for a long period of operation without renewal.

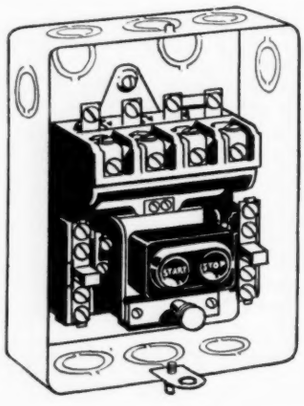
Hubs are alike with toothed flanges at their centers, so that it is possible to turn them end

for end to obtain new driving surfaces in case of wear. The torque rings consist of two solid steel rings with teeth cut on the inside and outside, thus providing quadruple engagement, or four points at which relative movement between the cooperating teeth can take place to provide for misalignment or endwise displacement of the shafts. The rings are loosely held in place within the cover sleeve, and the whole is handled as a unit. By removing either end plate, cover sleeve and torque rings can be moved in the opposite direction to secure initial alignment or in subsequent checking operations.

Features claimed for these couplings include: strength and durability under heavy loads, heavy misalignments, shock and vibration, such as often encountered on heavy-duty direct-connected and geared motor and engine drives. Fifteen regular sizes are available for shafts from 1⅞ to 12 in. in diameter at ratings ranging from 22½ to 4,840 hp. per 100 r.p.m., subject to occasional use of service factors on very high torque drives.

Starting Switch

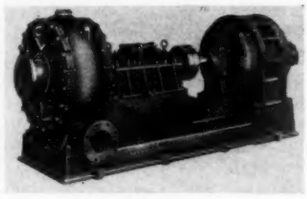
Allen-Bradley Co., Milwaukee, Wis., offers the new Bulletin 709 starting switch, which it asserts is the smallest across-the-line equipment ever built for starting and protecting up to 3-hp. motors at 110 volts, 5-hp. at 220 volts, and 7½-hp. motors at 440-550 volts. Features



pointed out by the company include: solenoid-operated switch; double-break silver contacts; electrical contacts, arc hood, etc., self-insulated and mounted directly on metal back, eliminating back-of-the-panel wiring; rubber mounting between switch mechanism and base plate to prevent noise and interference from vibrations; and generous wiring space. Three types are available: Form 1, start and stop pushbuttons; Form 2, suitable for use with two- and three-wire pilot controls; Form 3, regular automatic operation with hand operation in emergency.

Heavy-Duty Pump

Morris Machine Works, Baldwinsville, N. Y., offers the Type F heavy-duty dredging pump for handling extremely abrasive mixtures



against high heads. Construction details, according to the company, include semi-steel, manganese steel or special Morris alloys, depending upon the severity of the service, for all parts subject to wear, as well as large-diameter casings and impellers, so that the pumps will operate at a relatively low speed even against a high head. Both these factors reduce wear and the resulting maintenance expense, the company points out, and in addition the design includes a number of provisions for maintaining original efficiency, such as an adjustment to vary the position of the impeller to take up the wear on the suction ring; parts heavily proportioned for strength and rigidity; and provisions for the easy replacement of sections subject to wear.

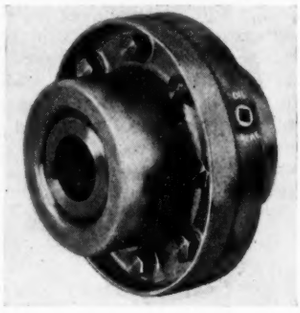
The pumps are built in a complete range of sizes from 4- to 15-in. discharge for total heads up to 150 ft., and for operation by either electric motors or belts.

Welding Electrode

An electrode for welding cast-iron by the "shielded-arc" process is announced by the Lincoln Electric Co., Cleveland, Ohio. Known as "Ferroweld," the new electrode has a steel core surrounded by a heavy flux coating which protects the arc from atmospheric gases injurious to the weld. Remarkably low heat is claimed, thus reducing the possibility of cracking. Welding is done intermittently, not over a 3-in. bead being laid down at one time, after which it is peened lightly, thoroughly cleaned and allowed to cool somewhat before the next bead is applied. The low current used is said to reduce materially the hardening effect ordinarily present along the line of fusion, thus making the weld more machinable, it is declared, than most cast-iron welds.

Light-Duty Coupling

Bartlett Hayward Co., Baltimore, Md., now offers the new, light-duty Fast's coupling in sizes from 1 to 2¾ in., rated at 2 to 15 hp. per 100 r.p.m., and with a maximum operating speed of 3,600 r.p.m. The new coupling is a companion piece to the standard Fast's coupling with external and internal gears permanently in mesh and inclosed in an oil-filled casing. The forged steel hubs of the standard coupling have been



retained, while die-cast sleeves and casings replace forged sleeves and casings for lower cost and equally satisfactory performance, the company states.

Rustproofer

Stonhard Co., Philadelphia, Pa., offers "Rustproofer," a liquid which it declares can be brushed or sprayed over new or rusted metal surfaces for preventing rust or stopping its further action, respectively. While naturally transparent, so that markings remain visible, aluminum powder, powdered graphite or dry red lead may be mixed with the product to give both color and rustproofing, the company says.